THE JOURNAL OF GAS LIGHTING
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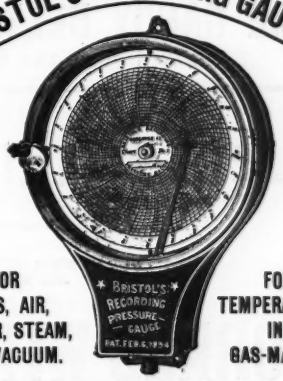

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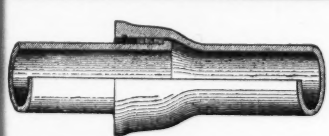

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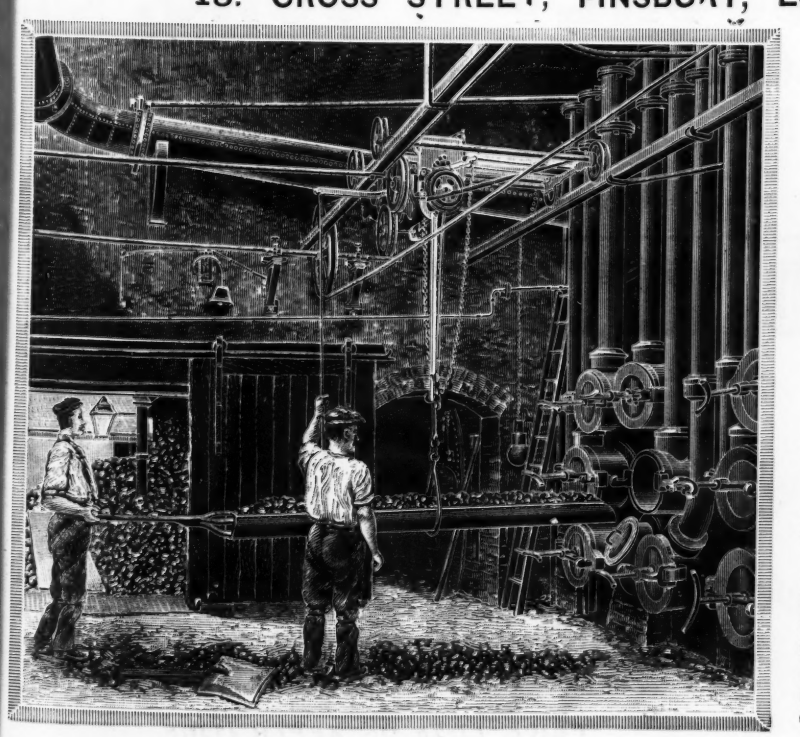

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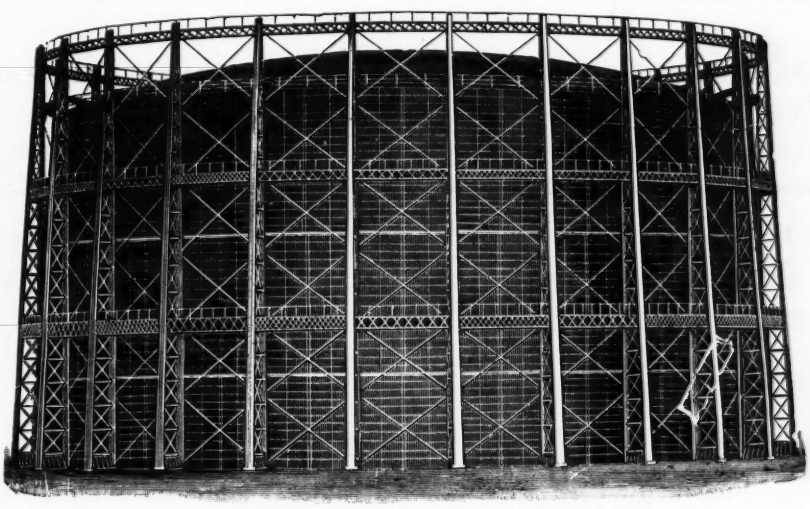

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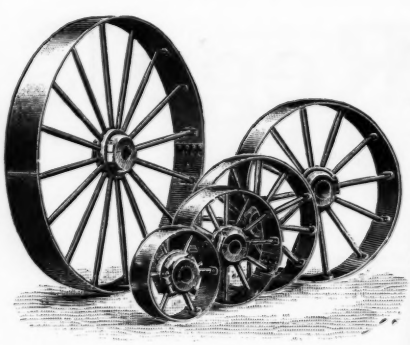

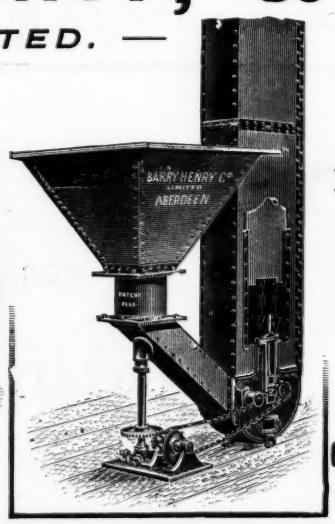

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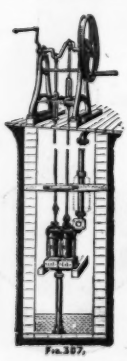

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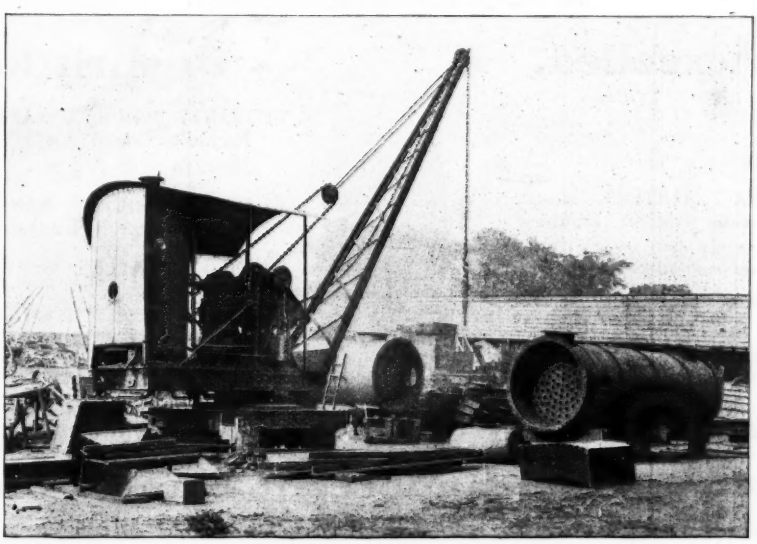

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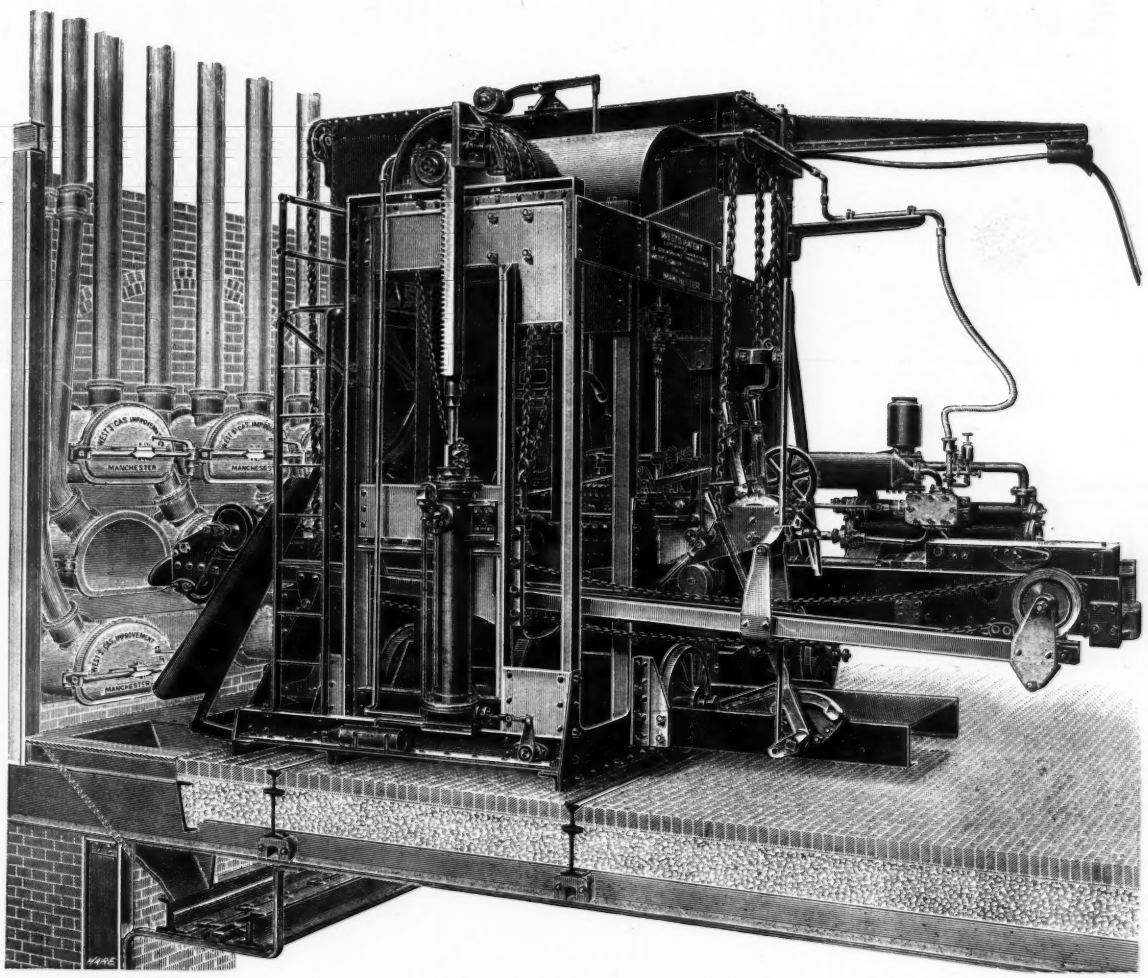

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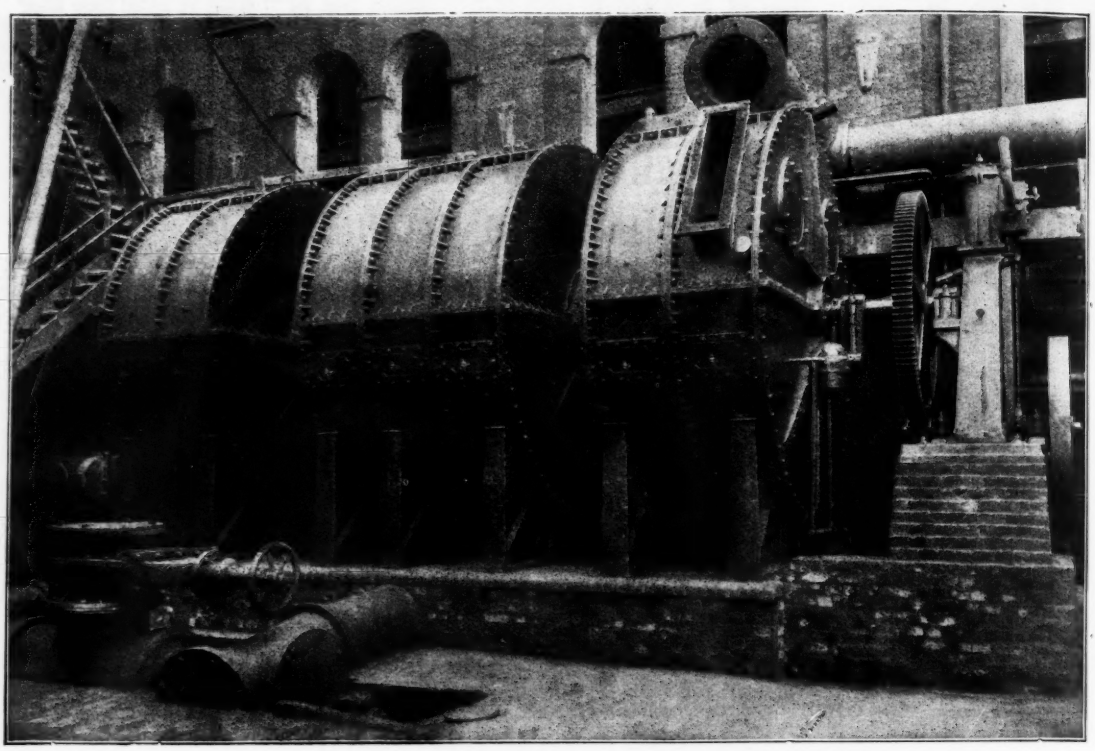

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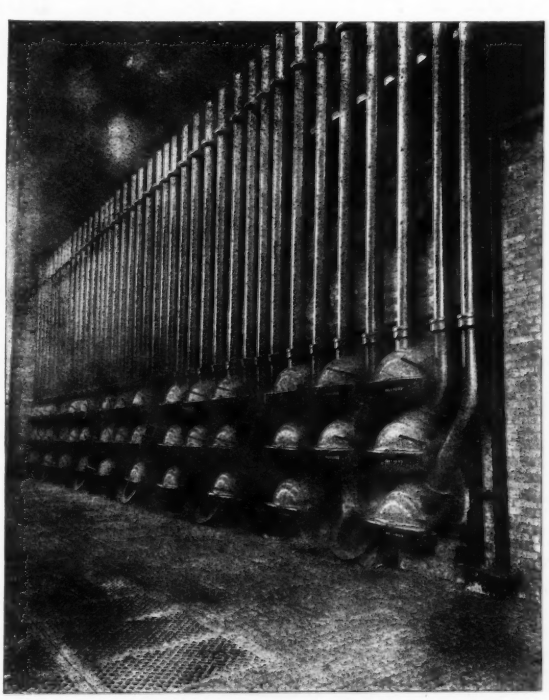

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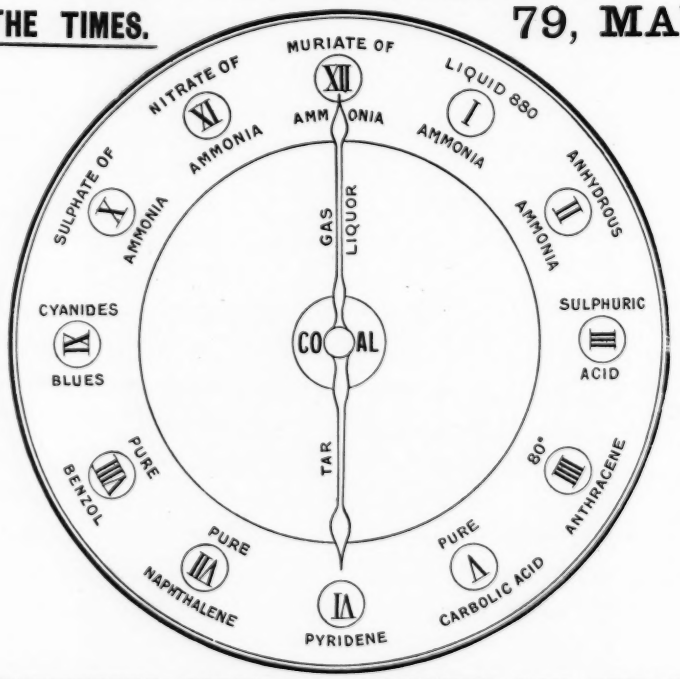

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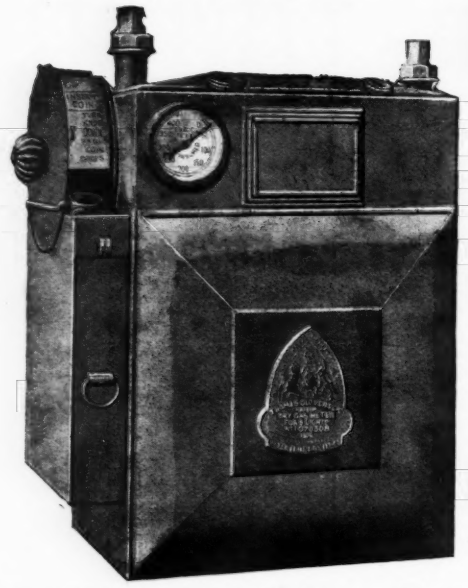

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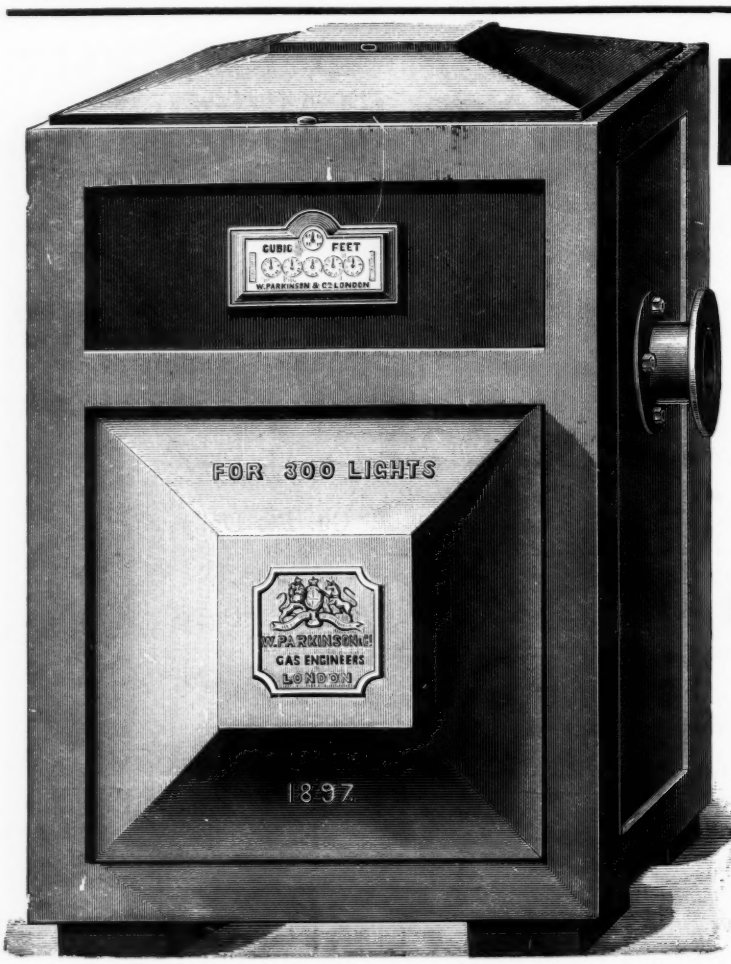

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VOL. LXXXIV., No. 2120.—TUESDAY, DECEMBER 29, 1903.

1903.

A Retrospect.

THE year which is now at its close will not be marked in the chronicles of the world's history on account of the occurrence of any very remarkable event. The nations have kept peace among themselves and within their borders; so that map-makers had no occasion to alter their representations of the political divisions of the earth's surface. For all that appears in these maps, the countries of the world have changed not at all for the year, which is another way of expressing the fact that during this period there was no great war upon the earth. Yet those who would fain argue from this salient fact that the conventional concomitants of Peace—that is, goodwill among men and an increase of welfare and happiness among all people—must have been largely realized, would experience difficulty in establishing their case by evidence. The truth rather appears to be, that the past year is to be distinguished as a time of settling-up and readjustment, more especially for the United Kingdom and the Britains beyond the Seas. The country has experienced in many ways the after-effects of a great and costly war, which, though completely successful, had to be paid for both directly and indirectly. Moreover—and this is the aspect of the case which many people have found a difficulty in realizing—it has proved to be impossible to restore the British Empire to the place it occupied in the world before the war. Thereby hang many things, the Imperial fiscal system among the number. Whatever else the past year may be remembered for, it will stand in British history for the period when the expediency of a revision of the means of raising the national revenue once more became a question of practical politics. After half-a-century of free imports, and of a fiscal system with no rational basis, the proposal was launched to remodel the whole system with respect to Imperial considerations as well as to national revenue necessities. Meanwhile, a phenomenon of unexampled import was unfolding itself in the financial Metropolis of the World—the City of London. This was nothing less than a shortage of money. What ultimately proved to be a false indication of the existence of large reserves waiting for investment—an enormous over-application for such new issues of the best class of securities as the Transvaal War Loan—had an effect which quickly passed when it was perceived that such exaggerated demands were fictitious. One bank after another discovered that so far from there being a plethora of savings in the country, their customers' balances were uniformly low. There had been a great increase of the issues of Government and Municipal Corporation stocks, which were largely taken up by the banks themselves and with their assistance, with the consequence that the available resources were overstrained, and the value of all such securities fell heavily. At one time, Consols were written down by holders to 85; and the average depreciation in value of investments in which bankers keep their reserves was estimated at anything between 5 and 10 per cent.

One result of this state of things was that the leading banks declined to continue the practice, which had become general, of underwriting municipal loan issues; and consequently several such issues proved failures. This incident served also to draw public attention to the amount of the indebtedness of British Local Authorities, which, if not actually excessive, had certainly been growing at a rate which suggested the expediency of the exercise of greater caution in the future. The Local National Debt, as it is called, has attained a high figure; but nothing is gained in the way of information regarding particular values, by looking at the lump sum. The real question is one of particulars, and the value of one corporation stock should not be affected by the price put upon another. Yet in practice these investments do constitute a class, and share a common fortune. Questions of local authorities' finance and policy bulked very largely in the domestic controversies of the year; and we almost grew ashamed of devoting so much space to the subject. The vexed topic of "municipal trading," for example, became a weariness to the flesh; but it was impossible to disregard it, for the reason that—to slightly vary the figure—it was as the skeleton at the national board. Everybody with money to invest, or only rates to pay, was asking anxiously whether or not the municipalities were overdoing it; and the anxiety was difficult to allay. The point upon which distrust of the local authorities centred was the very plain one that, notwithstanding the general increase in rateable value, the rates continued to rise. The question that naturally suggested itself on this statement of the case was, how far these movements could safely march together. To a certain degree, uneasiness in this regard was allayed by the explanation, proffered on all sides, that much of the local indebtedness was represented by assets of a remunerative nature. But signs accumulated to show that this excuse was beginning to fail. Up to the end of the year, for instance, though many "gilt-edged" securities recovered much of their lost value, the advance did not extend to corporation loans. It appears to be the public opinion respecting these so-called remunerative corporation assets, that they are not often very remunerative as they stand, and are certainly not convertible, nor capable of being separated from the fortunes of the locality. It might be remarked, also, that the practice on the part of local authorities of investing their reserve funds, where they have any, and their sinking funds, in the obligations of other local authorities, is not conducive to the restoration of confidence in this order of finance.

The course of the national gas industry during the year has not been less prosperous than at any past time. The value of gas companies' stocks varied considerably, partly as a consequence of the influences already mentioned. The market was at its worst towards the end of the holidays, in September; and quotations are, in many cases, actually ruling higher again than at any time of the year. Still, capital is distinctly dear, and not easy to obtain everywhere. The important matter of increases of gas consumption has occupied the attention of many gas companies, whose experiences in this respect are very various. Whereas the Metropolitan Gas Companies have not increased much, on an average, by reason mainly of the economy effected by consumers using the incandescent burner in ever-growing proportion—which the companies themselves, through their "maintenance" arrangements, greatly favour—the increases registered by the Suburban gas undertakings are almost embarrassingly large. Among the causes of this are probably the progressive displacement of the urban working-class population, due to the improved facilities provided for travelling to and from work in the central area, and the popularity of the prepayment meter system. The price of gas coals was marked down for the year's contracts by about 9d. per ton on the previous year's quotation; and the weakness of the market for all kinds of coal led to reductions both of prices and wages in the principal English coalfields. The cost of gas oil, on the other hand, rose towards the close of the year. The values of most gas-works residuals were well maintained, though pitch did not keep its highest price for long. The price of sulphate of ammonia remained very steady. One of the events of the year in the residuals trade was the acquisition by the South Metropolitan Gas Company of the tar-works of Messrs. Forbes, Abbott, and Lennard. The demand for benzol for the purpose of gas enrichment was affected by the progress of the movement in favour of the reduction of statutory illuminating power. The prospects of the newest gas residual, cyanogen, were scarcely such as to adequately reward the skill and pains that are devoted to its recovery.

The parliamentary record of the gas industry for the year was replete with incident. First and foremost of the Gas Companies seeking further statutory powers came the Gaslight and Coke Company, who succeeded in obtaining the additional loan capital they required, albeit at the cost of a reduced initial price and other concessions. A Bill of the London County Council, to afflict the Metropolitan Gas Companies in various and sundry respects, was withdrawn,

on the understanding that the various matters in dispute between the County Council and the Companies, as regards the testing of gas, should be referred to a Departmental Committee of the Board of Trade. Incidentally upon this, the Commercial Gas Company secured the unopposed passing of their Bill for the assimilation of their gas-testing arrangements to those of the South Metropolitan Company. The Crystal Palace District Gas Company promoted a Bill for, among other things, repealing the sulphur clauses of their existing Act, and reducing the standard of illuminating-power to 13 candles; but it had to be withdrawn, owing to the misapprehensions of a House of Lords Committee. Reduction of the illuminating-power standard to 14 candles under the most favourable conditions as regards testing were secured by the Derby, Plymouth, Maidstone, Hampton Court, and some other gas undertakings. A significant indication of the trend of opinion concerning the office of gas in the industrial world was the passing of an Act sanctioning the supply of Mond gas for fuel and power purposes in an area of the North-West of England.

An important point affecting the prospects of gas supply for power purposes arose in connection with the offer, by municipal corporations and a few companies, of electric power delivered to the consumer at the price of 1d. per Board of Trade unit of electricity, or even less. It is admitted that this quotation is considerably below the average cost of producing the unit of electricity, which is, indeed, rarely less than thrice this figure. The contention is, however, that the average cost of the unit, as computed from the year's working accounts, does not truly represent the actual cost of supplying a particular customer for power. The same remark is understood to apply to gas; but in no case has a gas undertaking made such a reduction in the charge for power gas as is commonly offered by suppliers of electricity. Reductions have been made—in some places of considerable amount—by gas undertakings that are desirous of developing a power consumption. Early in the year we recorded the intelligence that the Directors of the Malton Gas Company (Yorkshire) had decided to make a "cut" of 33⅓ per cent. with a view to meeting a demand of this order; and this we believe to be the first example of a policy which in particular localities will receive very considerable development. As a matter of fact, the price of 1d. per electrical unit for power supplies is only a low one as compared with other sources of power when the amount is small—say, less than 30-horse power; and even then it is dearer than gas-engine power with a price of gas of 2s. 6d. per 1000 cubic feet and under. This competition for the patronage of the power user was one of the features of the year for both gas and electricity supplies. The convenience of electric motors was found to turn the scale in their favour for many purposes.

The competition of incandescent gaslight, both high and low power, with electric lighting, arc and incandescent, was very keen during the year, and led to various developments. The most significant of these, perhaps, was the promulgation of the long-delayed decision of the Corporation of the City of London to adopt gas for lighting all the City streets, with the exception of the main thoroughfares actually provided with electric arc lamps. Similarly, the selection of incandescent gas for street lighting elsewhere than in the City of London has progressed steadily, if slowly, where the choice of an illuminant was not prejudiced by other considerations than those of efficacy and cheapness. Speaking generally, the fortunes of incandescent gas for lighting were not exposed to the rivalry of any new illuminant competent to displace it in public favour. Remarkably enough, considering the apparent similarity of the problems to be solved in the two cases, the numerous and well-sustained attempts to make a thoroughly reliable and useful incandescent oil-lamp have met with vastly more difficulty than anything that has been encountered, and overcome, in the development of the incandescent gas-burner. The acetylene lighting industry appears to have found its level, which is not a high one in general lighting.

Who says incandescent gaslight, says mantles. Despite the concentration of all the individual powers of modern chemical science in the quest, no substance has been found to take the place of the rare earths, thorium and cerium, in the composition of these appliances, on the quality and cheapness of which so much of the prosperity of the gas industry at home and abroad depends. Failing an adequate supply of suitable mantles at reasonable price, it is hard to think what turn the fortunes of the gas industry would take. Impressed with this consideration, and also with the apparent dependence of the whole industry upon a very few known sources of supply of the necessary substances named, the largest of which is the monazite sand deposits of the Brazilian littoral, the Directors of the South Metropolitan Company took the unusual course of despatching to that country one of their Engineers, Mr. J. Tysoe, with a commission to negotiate for a Government concession of a sufficiency of the raw material to prevent the possibility of a shortage or of a "corner." The object of the mission was not immediately attained; but it is believed that the real purpose of the enterprise, which was to keep the source of supply open to the play of ordinary commercial competition, is yet in a fair way of being secured. In the meantime, the increased popularity of incandescent gas lighting in all its branches was very marked, and probably the greater number of British gas undertakings now do the maintenance of burners and mantles, which is found to be really the best means of introducing the system at all widely among consumers.

The unchallenged supremacy of the famous incandescing mixture prescribed by Dr. Auer von Welsbach is all the more remarkable, by reason of the truly wonderful advance of knowledge regarding the phenomena of radiant action of matter. The feature of the year in science was the publication of the properties of the newly-discovered element, radium, and its analogues. Once more truth was found to be stranger than the wildest fiction. Though imaginary forecasts of the developments of human knowledge as to the secrets of the universe and their application to the service of civilized communities, have long been a favourite exercise of speculative intellects, it never entered the mind of one of these would-be prophets to anticipate the discovery of a substance possessing the properties of radium—a metal, if it is a metal, which radiates light and heat without appreciable loss of substance; which, without any provocation, pours out another element, the gas helium; and originates rays of so powerful a character that one of its discoverers, M. Curie, has owned that he would be afraid to enter a room known to contain a kilogramme of it. There is not at present any probability of the appearance on the earth of such a weight of radium, which is the scarcest of all substances, with a purely fancy price of about £750,000 per ounce. This dearness is in the main due to the extremely onerous nature of the process by which the substance is separated from the mineral in which it occurs in Nature; and it is a humbling reflection for those who might be inclined to attach an exaggerated value to our science, that this wonderful element of the earth's crust should have lain hidden to this day, notwithstanding the fact that the agencies by which it was at length detected and obtained are common and quite familiar to every chemist and metallurgist.

In gas engineering, one gain of the year has perhaps been a clearer understanding of the conditions affecting the choice between inclined and horizontal retorts for carbonizing ordinary gas coal. In the opinion of some engineers, the truth has emerged from amid much confusion of testimony, that the controlling factor in this selection is the physical nature of the coal to be dealt with. There are some kinds of gas coal which, it is said, can be quite successfully carbonized in inclined retorts; and where the carbonizer happens to be in the fortunate position of being able to command an unfailing and unvarying supply of suitable coals, at a fair and not enhanced price on this account, he can doubtless secure all the advantages of the system. On the other hand, there are gas coals which, it is asserted, will not answer satisfactorily in inclined retorts; and where the gas manager is so situated as to have to do the best he can with such coals, either occasionally or as a regular thing, inclined retorts are not for him. It is therefore for every gas manager to choose for himself, not from what others have experienced, but on the merits of his own case. Only by bearing this rule in mind, is it possible to understand why there is still such irreconcilable diversity of judgment concerning the two leading systems of arranging carbonizing plant. It is now quite certain that the more extravagant expectations once formed by some with regard to the prospect of inclined retorts superseding horizontal settings everywhere, are being abandoned. The capability of the horizontal retort to deal with any and every description of coal, or what passes by the name at a pinch, is its salvation as a carbonizer. A remarkable accession of strength has also

been brought to this system by the successful introduction of mechanical improvements in charging and discharging. The year has registered several improvements of this order of retort-working appliances—notably the De Brouwer "projector" and the "Parisian" charger, the combination machines of West and Fiddes and Aldrich, and the renewed attempts to adapt the method of pushing to clear retorts of coke. At the same time, continued progress was made in the application of labour-saving machinery to the operations of carbonizing, from the first conveyance of the coal to the final disposal of the coke. For these reasons, a retort-house of 1903 presents quite a different aspect from the hand-worked plant of a few years ago; and the alteration is not confined to large works. Experiments with vertical retorts were revived by Dr. Bueb in Germany, and Messrs. Settle and Padfield in England, with news of other proposals (as yet untried on a practical scale) from America. In horizontal working, a feature of the year, too, is the large trial installation at the East Greenwich works of the South Metropolitan Company, of retorts of small section—twenty in a bed—to deal with light charges in short periods.

Outside the retort-house, the attention of gas engineers has been largely occupied with the investigation of the causes of naphthalene deposits in the works and distributing mains, and with experiments designed to cure this evil; which is recognized as constituting one of the greatest hindrances to that reliability of service which is so essential for the well-being of the industry. The Committee of Inquiry into this subject instituted by the Southern District Association of Gas Engineers, have worked steadily at it throughout the year, with the valuable assistance of their technical adviser, Dr. Colman; and bright hopes are entertained that the problem will, in course of time, be cleared of some of the mystery hitherto enshrouding it and baffling individual searchers. In the meantime, one or two experimental gains have been signalized, such as the benefit of working gas condensers reversibly—an improvement due to Mr. Carpenter. More attention has also been given to the freeing of gas from suspended tar and vapour by the employment of impact, or centrifugal extractors. The transmission and distribution of gas at higher pressures and increased velocity through mains by mechanical "booster" fans, driven by gas-engines or steam-turbines, has become more general; though intelligence of very high-pressure gas distribution (pressures of 50 lbs. or thereabouts) is still confined to some American examples.

In the branch of mechanical engineering which lies nearest to gas engineering—the development of motive power—a feature of the year was the growing popularity of the steam-turbine, already mentioned in connection with the use of fans for the increasing of gas pressures. Some very large applications of this type of steam-engine are recorded, which also bear the interpretation of competing with the big gas-engine, using producer gas, as a cheap and convenient source of large powers. Though a good deal has been said in technical circles concerning the theoretical economy of these large gas-engines, and the practicability of constructing and working them of any size up to a 6000-horse power unit was asserted, the commercial advantages of these motors, except for the utilization of blast-furnace gas, were not generally accepted. A gas-turbine development is one of the promises of the near future. As regards motive power for the ordinary purposes of gas-works, including gas exhaustion and "boosting," the claims of the steam-turbine appear to call for greater recognition. A project that came to light during the year, and will probably be heard of in the future, was for the reduction of the cost of the sea carriage of coal for short coasting voyages by a modified system of barging, worked by tugs. Generally speaking, the matters of technical interest which came before gas engineers in the course of the year were mainly of a physical and mechanical, rather than of a chemical character. Some advances were made in the photometry of gas and other artificial lights.

The Labour questions of the year did not touch gas manufacture very closely, unless it may be placed upon record that the very best work done in this country with respect to the reconciliation of Capital and Labour continued to be the profit-sharing and co-partnership systems of the South Metropolitan, Crystal Palace District, Commercial, Chester, and Newport Gas Companies. It is to be regretted that no addition was made to the number of these schemes. Nor can we recall any instance of an endeavour on the part of employers to improve upon the idea. Notwithstanding the marked extension of labour-saving machinery and plant in gas-works, recorded in another paragraph, no opposition to anything of the kind was offered by the workers in any of the factories concerned. From this fact it is to be inferred that the animosity once (and not very long since) entertained by the British gas worker to the "iron man" has died out—probably through lack of support by the Trade Unions, which have had other cares to occupy their official counsels. Whatever the reason, however, it is worthy of remark that the employers in British gas-works are once more masters in their own house. On the Continent of Europe, and in the United States also, strikes have still been troublesome. Matters being as they are in British gas-works, and the supremacy of the lawful powers being unchallenged, it is gratifying to be able to point out that, even where the change of methods is most conspicuous, the actual amount of the displacement of labour by machinery has not been great. There is as much employment in the gas industry as ever; what labour-saving machines have really done being to stop the increasing demand for certain kinds of rough labour, which it was becoming more and more difficult to secure. Coal-trimming at 15s. a day, for example, is now a thing of the past—which is all the better for coal-trimmers themselves. Apart from gas-works, the Labour history of the year is that of the progressive, irresistible reduction of the power and pretensions of agitators and Trades Unions to the reasonable limits of law and common sense. The Railwaymen's Union had to pay £20,000 for the Taff Vale strike. Lord Penrhyn's quarrymen dropped their strike without the gain of a single point. The turbulence and arrogance of the South Wales coal miners was chastised in the matter of the "stop-day" practice. In several cases, experiments were instituted in the matter of altering the hours of daily labour, with the object of diminishing the habit of losing the first "quarter." This movement seems likely to spread, especially where men have to travel some distance to their work.

The law reports of the year do not contain many leading cases of vital interest. The South Metropolitan Gas Company were engaged in litigation with the London County Council over some questions of gas testing, chiefly concerned with the sudden discovery of the Council that Sunday testing is imperatively necessary. The rapid extension of electric tramways brought into the Courts several questions relating to main-laying; the chief instance being that of Ilford, which established a valuable precedent. The case of the *Gaslight and Coke Company v. Cannon Brewery Company* was of interest in connection with the question of liability for gas bills in arrear. The case of the *South Shields Corporation v. South Shields Gas Company*, in which the defendants recovered, dealt with a point of the law of main and service laying. The law as to payment of back-dividends was laid down by the House of Lords in the *Kent Water-Works Company v. Lamplough*. The temptation of the money-boxes of prepayment meters proved a source of trouble in many instances, as usual, which was not lightened by the Magistrates holding that money put into the slot of a meter is paid to the Gas Company. There was some litigation under the Workmen's Compensation Act, but nothing specifically affecting employment in gas-works. Indeed, the paucity of litigation relating to gas companies, or the multifarious industries ancillary to gas manufacture, was a conspicuous circumstance of the year.

The technical societies connected with the gas industry fulfilled their office with their usual efficiency; and their numbers did not suffer further diminution. The restored and united organization of the gas engineering profession of the United Kingdom, the Institution of Gas Engineers, held a well-attended first meeting in London under the presidency of Mr. Andrew Dougall, which was full of promise for the future. Since the meeting, it is understood that the Council have been engaged in the consideration of means to make the Institution more useful to the profession than any earlier organization had been. So far the only overt result of this process of incubation has been a proposal to the various District Associations for their voluntary affiliation to the Institution, and which proposition is sufficiently familiar to those who have followed the domestic politics of the industry of the past few years. A proposal that the Institution should officially patronize a gas exhibition at the Crystal Palace this winter was first accepted

by the Council; but, after the preliminary work of the Palace authorities had made some headway, the support was withdrawn on the recommendation of a Committee appointed to advance the project. This was disastrous to the prospects of getting together a representative show; but there are a few notable exhibits at the Palace to-day. The various District Associations all did good work; and in this general commendation must now be included the Junior Associations. During this period, instructed opinion was passing through a critical stage with regard to the merits of the last of the encyclopædic societies still extant, the British Association for the Advancement of Science. It has come to be pretty generally agreed that the best days of these "omnibus" scientific societies are past; the progress of specialization having rendered them practically obsolete. The reason for this doubt lies in the different character of modern technics compared with the all-round nature of professional attainments of the men of the early Victorian era who have recently died out. Nowadays, the matters that an expert technician thinks it alone worth while to bring before his fellows are almost unintelligible to those who have not specialized in the same subject; with the result that his papers are only interesting to a few. This is the reason why professional contributions of real value find their place in the Transactions of small and select societies, and in periodicals which the general public rarely hear of. A feeling found expression that such papers should not be read aloud at meetings, but should be circulated among the members in advance, thus leaving the whole of the time of the meetings free for discussion.

It has been our custom to appropriate a paragraph of these annual reviews of gas affairs to a statement of the casualties and catastrophes that have marked the course of the industry during the year. But it has been more and more difficult, as time has gone on, to fill a few sentences with the recital of matter of this nature. An unfortunate case of asphyxiation by coal gas, resulting in the death of the Gas Manager and a stoker who went to his assistance, occurred on the 13th inst. at the works of the Mountain Ash District Council; but, on the whole, the year has been notably free from serious accidents specifically referable to gas manufacture and utilization, as such. A great gale in September did much damage to a partially-erected holder at Portsea; but this was not, strictly speaking, a gas accident, any more than is the foundering of a vessel with a cargo of gas coal. The fears entertained by the management of some gas undertakings lest the extension of their responsibilities for gas supply beyond the consumer's meter should land them in troubles of this origin, have proved to be baseless. On the contrary, the circumstance of this extension having become common is chargeable with bringing about a decreased gas-explosion rate through the suppression of the water-slide pendant. Gas companies have been greatly exercised in regard to the possibility of electrolytic damage being done to their mains by the leakage of current from electric lighting and traction systems; but, so far, nothing serious of the kind has occurred. On the other hand, nothing has transpired to induce the Government to take definite action upon the report of the Committee on Carburetted Water Gas, the local agitations in regard to which died away. The employment of flueless gas-heating stoves was reported upon very sensibly by the Chief Inspector of Factories. Occasional gas explosions in electric light street boxes continue to be reported. Among miscellaneous features of the past twelvemonth that call for passing notice before the history of the year is done with, the wet, chilly, and stormy weather must not be overlooked. The intimate connection between the temperature of a season and the demand for gas is well known; but the influence of the continuous rain which has made the past year memorable among meteorological registers in the gas business is more a matter of conjecture. So far as trouble and expense due to the flooding of gas-works goes, there was plenty of it during the reputed summer; many gas managers having occasion to question the traditional advantage of the gas-works being situated in the lowest-lying part of the district. Truly, the wet weather deserves to be recorded among the calamities of the year, if only on account of its bad effect on the seasonal trades.

The tale of personal changes in the ranks of the industry is very full and varied. The most conspicuous of these movements was the resignation of Mr. J. W. Field of the offices of Secretary and General Manager of the Gaslight and Coke Company, and his election to the Board of the Company in succession to Mr. J. B. Paddon, who retired on account of advanced years and enfeebled health. The offices held by Mr. Field were divided; Mr. Henry Rayner being appointed Secretary, and Mr. D. Milne Watson the General Manager. A further rearrangement of the principal executive officers of the Company followed, Mr. W. B. Wright, well known as an engineer of the old Imperial Gas Company, relinquishing the Bromley post, and being succeeded by Mr. Lacey, from St. Pancras. The new Engineer at St. Pancras is Mr. Reeson, from Beckton. A new post carrying the superior charge of matters relating to the consumers' interests was created, and given to Mr. F. W. Goodenough. Mr. H. H. Jones resigned his position as Engineer of the Wandsworth and Putney Gas Company, and was succeeded by Mr. H. O. Carr. Mr. F. D. Marshall retired from the engineership of the Danish Gas Company, and received the appointment of Consulting Engineer to the Company. Mr. Alexander Smith retired from Aberdeen, after 36 years' eminent service. Mr. D. Coats Niven resigned the engineership of the Oriental Gas Company, in Calcutta; Mr. J. C. Watson succeeding him. Mr. George Anderson gave up his consulting practice, and was succeeded by his son, Mr. R. Bruce Anderson. Mr. T. Holgate retired from the management of the Halifax Corporation gas undertaking. Mr. James Paterson was appointed Engineer to the Redhill Gas Company; Mr. Douglas H. Helps, who filled that position, going to Reading. Abroad, General Hickenlooper, of Cincinnati, retired.

Death removed Mr. William Foulis—at work till the last—from the office of Gas Engineer to the Glasgow Corporation. It will be long before he is forgotten. He was succeeded by Mr. Alex. Wilson. Mr. James Glaisher died at a ripe old age, as much respected as renowned. Sir Frederick Bramwell was one of the last of the all-round civil engineers, whose real distinction was a supreme native gift of wit and humour. Mr. Thomas Fletcher had done good work for the gas industry by making the design of gas-heating apparatus scientific. Mr. H. Packham, of Kingston-on-Thames, was well esteemed by everyone who knew him. Mr. Andrew Stephenson was a very popular man in his vocation. Mr. Charles Taylor for many years represented Derby in the profession. Mr. G. B. Jackson was for some time the Secretary of the Manchester Corporation Gas Committee. Mr. William Jones, the Manager of the Dalton-in-Furness Gas-Works, met his death by an extraordinary accident on his own works. Mr. George Helps, who only last year retired from the position of Secretary of the Bath Gas Company, was a familiar personage in the industry for half-a-century. Mr. James Thomas, of Bodmin, was one of the old school of gas managers, with 39 years' of good service to his credit. Mr. J. Thomson, of Inverness, was suddenly taken from the very midst of his work. Mr. Eugene Vanderpool was one of the best known and liked of American gas engineers. The list of the losses of the industry by death this year will be seen from the above to be exceptionally long, and to contain the names of several engineers of world-wide reputation.

And now our task is once more accomplished, and we are able to turn the page on the record of the past year, with chastened sorrow for the good men who are gone from our midst, but also with confident hope that the future will be bright. The gas industry of the United Kingdom, during the last few years, has passed through a period of exceptional trial, and it emerges from this probation at least as strong as, if not stronger than, ever. Nothing that the years have hitherto brought in their courses has offered the possibility of coal gas being dispensed with in the life of modern towns; but the utilities of this indispensable necessary of town life have continually been extended and increased. That there is no apparent boundary to this process of growth and development is the best possible augury for the happy future of the industry.

A Twopenny Reduction for South London.

Even if they had no express intention of doing so, the Directors of the South Metropolitan Gas Company have added another rampart to their defences against the assaults of those who asseverate that the consumers in South London are worse off as users of, and payers for, 14-candle gas than they were in the 16-candle days, and those who, in their extreme animosity to the

reduction of illuminating power—while they shrink from assailing the personal probity of Sir George Livesey and his colleagues—do what is practically the same thing by accusing the Company of having done something before the reduction of the illuminating power of the gas for which it is impossible to find any other short and more clearly-defined term than that of fraud. The Directors last Wednesday resolved to lower the price of gas by 2d. per 1000 cubic feet—2s. 3d. to 2s. 1d.—from the present quarterly index-taking. This 2d. must mean to the Company and to the consumers not many thousands of pounds short of £100,000 a year. This announcement should, and there can be no doubt it will, do much to confound the enmity that has been directed against the Company from Spring Gardens and elsewhere. It is a bold resolution when it is remembered that, in spite of the predictions that were made that the consumers of South London would suffer by having to increase their consumption through the lower illuminating quality of the gas, the Company's rate of increase has not—the unceasing supplementing of the number of consumers notwithstanding—been maintained at former rates, owing simply and solely, we believe, to the constant extension of the use of the incandescent burner.

Consumption Reducing Power of Incandescent Burners.

The policy of the Board of the South Metropolitan Company to-day is one of consolidation and protection; and one means that has been taken in the furtherance of this is the fostering to the utmost of the adoption of the incandescent burner, leaving to the increment of consumers the upholding of the consumption. We are not, at the moment of writing, quite sure as to the precise number, but it is something like seventy men that the Company are now keeping constantly employed in fitting up incandescent burners; and when it is considered what this large company of men practised in the work can do in substituting the old wasteful flat-flame burners by incandescents, it is recognized that the saving to the consumers in gas, from the work of these men alone, must be something enormous, without taking into account privately made changes. It will be a good thing for the Company, and for gas suppliers generally, when the incandescent burner has come to be universally used by gas consumers. Until that time is approached, the level will not be reached, when the statement of percentage increases of consumption can be anything more than an indication that the volume of business, as measured by output, is being retained. If the reduction in the consumption of gas effected by the incandescent burner in the country could be calculated, what a saving to the consumers would be shown, and what a large capital expenditure on new works that would have been required, assuming the gas business continued its old prosperous course, it would represent! However, that is an exercise that, before it could possibly be completed, would have no value in view of the daily progress incandescent lighting is making. In view of the immense growth in the number of their points of consumption, and yet the comparative smallness of the additional consumption since the lowering of the illuminating power, through the changing condition of the lighting business referred to here, the Directors of the South Metropolitan Company must be warmly congratulated on their last courageous act, which now more than satisfies the promises made when the Company were before Parliament in 1900.

A Gas Workers' Journal.

Example has a wonderful influence. It has brought the men of the South Metropolitan Gas Company to lead and to initiate; and having done so, a third prominent characteristic of their pattern—perseverance—will certainly follow. For their common good they have, on their own initiative, established a monthly paper; and, in this respect, we believe they take the lead among gas workers in this or any other country. The Directors of the Company, though doubtful at first as to the ultimate success of the proposal, have, through the persistency of the men, given to the enterprise their thorough approval, and have stated their willingness to help in it, though the entire responsibility of conducting the periodical is to remain with the employees. The title given to this new literary venture is the "South Metropolitan Gas Company Co-Partnership Journal." The title of "Journal" does not commend itself for a monthly periodical of the kind; the word "Messenger" which is found in the prefatory letter Sir George Livesey has (by request) addressed to the men in the first number, appeals to us as a far better descriptive name. However, the question of the title is a small matter. The objects of the periodical are of more importance; and the special and worthy one is "to help forward and strengthen the principle of co-partnership as the best means of uniting capital and labour." It is intended, we learn from a letter addressed by one of the workmen promoters to the Chairman, to invite articles for its pages on the subjects of co-partnership and engineering from the management and staff of the Company, and essays and correspondence from the men, together with suggestions and ideas which may benefit both the Company and themselves. It will likewise serve as a medium of communication between the several works as to the various funds in which the employees are concerned, and as to the doings of the works' clubs and institutions. If those responsible maintain the level, in point of literary and printing excellence, of the production month by month attained by the first (or January) number, success cannot but be assured. This first number contains seventeen pages of matter; and, the conductors have very appropriately given as a frontispiece a photograph of their mentor in co-operative and other good works. The charge of a penny for the monthly suggests that it is to be self-supporting; and, as the men can number among themselves no less than 4380 co-partners in the Company, holding (with deposits) stock, as their Christmas card informs us, of a market value of £182,615 in the undertaking, there is a good scope for the circulation of the monthly. Cordially we praise the effort and the first result; and hope there will be such enthusiasm displayed in connection with it, that it will be an abiding feature of the life among the South Metropolitan gas workers, and a source of additional strength to the amalgamation of the interests of capital and labour.

Municipal Insurance.

Having considered an influential petition asking them to take such action as they might deem expedient to relieve the citizens from the "excessive charges now demanded by fire insurance companies," by starting a municipal scheme for insuring all buildings within their area, the City Lands Committee of the Corporation of London have reported adversely on the proposal. The reasons given for this decision may be commended to the notice of those who advocate the placing of this additional duty upon the shoulders of municipalities. The Committee point out that parliamentary powers would need to be obtained before a compulsory insurance premium rate could be legally levied in the City, and that the security for the insured under such a scheme seems hardly tangible enough. Even with comparative immunity from fire loss, it would take some time to build up a substantial reserve fund; while, on the other hand, should extensive losses sweep away the reserve and cause a deficit, a special rate would have to be fixed and levied on all the policy-holders. Most insurers, they think, would prefer the security represented by the accumulated reserve funds of the various insurance companies, amounting to about forty million pounds. Taking into account these and other facts, the Committee thought the scheme would not be conducive to the best interests of the community; and they were also of the unanimous opinion that it would be unwise for the Corporation to undertake the great responsibility which would be involved.

Reversing the Mixing of Coal and Plain Water Gas.

In the system of mixing blue water gas and coal gas, the practice so far has been to pass the former through coal-gas retorts, and so unite it with the production of the latter. An inversion of this practice is proposed by Mr. Walter R. Jones, who was at one time Engineer of the Rome Gas-Works. The fundamental principle of his process is the mixing of the two gases while both are at a high temperature, in order that the hydrocarbons which ordinarily form the tar may be taken up and fixed. In doing this, he, in effect, reverses the method of operation that has been so largely the subject of controversy. He takes the coal gas and introduces it first into water-gas generators, where the mixing of the gases takes place, and then the combined gases are taken on to superheating chambers, where the hydrocarbons are fixed in gaseous form and rendered incondensible. The three methods and the forms of apparatus that he

proposes are fully described in the specification of his patent, from which the chief parts and illustrations have been taken for the article appearing on p. 822. Not one of the least interesting points is that while the first and second methods can be used in connection with existing benches of retorts, the retorts in the third method "may advantageously be made three to nine times the capacity of ordinary retorts," which proposition gives visions of carbonization being carried on with comparatively huge bulks of coal. The reading of the specification leaves little doubt that Mr. Jones has gone into his proposals in a thorough and scientific manner. Specifications, however, at the best, are bald and unsatisfying things. They leave off, as a rule, just at the point where one wants to know more. Here the methods and the plant are described; but what about the results? It is the opinion of Mr. Jones that, up to the date of his patent, no reliable or practical results have been attained in treating the total output of coal gas with water gas so as to render the mixture permanent and incondensible; and his new methods, which invert present systems of operation, are the consequence of that view. This indicates that behind his patent there is a considerable amount of study and experimental work; and it is of this that we should like Mr. Jones to give us now. It is such a supplement to the specification that will add to the interest his invention is sure to evoke.

The Charge for Gas for Power Purposes.

Among the undertakings that have so far not seen fit to make any reduction in the price of gas used for power purposes may be cited that at Liverpool, where the charge, irrespective of quantity, is at present 2s. 8d. per 1000 cubic feet. This is not by any means an exorbitant figure; but the refusal of the Company to grant any concession to manufacturers is stated by a local paper, in the course of a long article attacking the policy of the Directors, to have caused great dissatisfaction, and "a considerable loss to the shareholders, as gas plant is now being erected by a number of private individuals." Though a selection of instances are quoted in which differential rates are charged, it need hardly be pointed out that such a policy is at the present time very far indeed from being universal. Then, again, in many of the cases in which a reduction for power purposes is made, the charge for lighting is higher than at Liverpool. If it were possible to grant the concession in any other way than by raising the price to the lighting consumers, it is to be presumed that the Directors would do so; for, as business men, they are hardly likely, if they can help it, to lose customers whom it would be worth their while to retain. Indeed, if there is one point more than another on which the writer of the article alluded to can make his mind easy, it is that the Board are at least as competent as he is to look after the interests of the shareholders. However good may be the theory of granting a reduction in the price of gas used for power purposes, it is, of course, a matter that must in individual cases resolve itself into a question of expediency. And so far apparently the Liverpool Gas Company have not found it expedient; for they have resolved to adhere to their present policy after hearing all the arguments that a deputation of manufacturers were able to adduce on the subject. The newspaper to which we refer has, it must be admitted, ably presented one side of the question; and at the next meeting of the Company it is to be expected that the Chairman will as ably put forward the other. Until then, it would be unfair for anyone to pass judgment on the refusal of the Company to make their price dependent on the consumption or the purpose for which the gas is required.

Gas and Electricity as Employers of Labour.

A correspondent has made the suggestion that it would be interesting if a table was published showing the number of people engaged in electricity undertakings, in order that a comparison might be made between these works and gas-works as employers of labour. The figures given in to-day's issue have therefore been compiled from the 1901 census, in the same manner as were those which appeared in the "JOURNAL" a fortnight ago relating to gas workers. For more than one reason, an exact comparison is an impossibility; but some approximate idea of the respective value of the two industries for the purpose named may be arrived at on the basis of the Board of Trade returns. These returns relating to electricity works, both companies and local authorities, in the United Kingdom for 1900 (the latest available) dealt with 228 undertakings; while the number of gas-works making returns for the same year was 693—or practically three times as many. Now look at what is revealed by the census. The number of persons occupied in connection with gas-works in the United Kingdom is given as 54,110; and those engaged in England, Wales, and Scotland in electricity supply as 3419. It will be observed that in the latter case Ireland has not been included; the workers there not having been separately scheduled. This, however, cannot possibly make any material difference in the result, which shows that gas undertakings are, proportionately, far larger employers of labour than undertakings engaged in the supply of electricity. Making a very liberal allowance for Ireland, and multiplying the total number of electricity workers thus arrived at by three, so as to bring these works up to the number of gas-works enumerated in the Board of Trade returns, it would seem that at least four and a half times as many men are needed to carry on the operations of a gas undertaking as are required on an electricity supply works. As has already been remarked, no claim whatever can be made that this is anything approaching an exact calculation; there are various other points which are doubtless entitled to be taken into account on both sides. So far as they go, however, the figures certainly indicate that, by supporting gas, people will be the means of furnishing employment for many more workers than would be the case if they favoured electricity. This is surely—more especially at a time like the present, when there are so many unemployed who are clamouring for work—a matter which is deserving of some attention.

What Trade Unions Can Do.

The newspapers last week contained reports of two cases which show the extraordinary lengths to which some Unions are prepared to go in the exercise of the great power with which the working men of this country have been rash enough to endow them. In the first of these, a member of the Goldbeaters' Trade Society, who contemplated taking a job that they "did not believe in," (though he had not done any work in connection with it), and which was against one of their rules, was turned out of the Society. He was then unable to obtain any employment; and after having had scarcely any food for over three weeks, he was admitted in a deplorable condition to the infirmary, where he died—the doctor stating that his death was accelerated by destitution and want of attention. At the inquest, it was pointed out that deceased had been a member of the Society for considerably over twenty years, and that he had not broken the rules, though he was on the point of doing so. No wonder the Coroner remarked that the case was "a delightful exposition of the tyranny of some societies." But the second example is even worse. In consequence of slackness of work at Stourbridge, a dozen glass makers accepted an offer of employment in America; but on arrival there, they were stopped, and ordered to return to England. In view of the well-known United States law in regard to such matters, there is nothing in this fact to cause astonishment; and perhaps those who are well versed in the ways of a certain class of Trade Union officials will not be greatly surprised even at the announcement that the intentions of the men were brought to the notice of the authorities by a cablegram from the Secretary of their own Trade Union in the Stourbridge district. The "Pall Mall Gazette," however, confesses to amazement at the news, and admits its inability to understand the policy which led to such "an incredible piece of dirty work" as the denunciation of these men by one of their own leaders "for the crime of attempting to escape starvation," which, it says, "must give the American workman a high opinion of the standards of honour and loyalty which prevail among his British compeers." These two instances of Trade Union methods merit all the publicity they can get.

The "Flicker" photometer of Messrs. Simmance and Abady was introduced to the notice of the members of the Physical Society at their meeting on the 11th inst.

The Beal Medal of the American Gaslight Association, for the best paper read at the annual meeting, has been awarded to Mr. I. N. Knapp, of Philadelphia, for his "Notes on Cement Masonry," submitted at the meeting of the Association held in New York in October last year, and noticed in the "JOURNAL" for Dec. 9, 1902.

WATER AFFAIRS.

The Principal Events of the Year.

In commencing a review of the events of the year now fast closing, so far as they bear upon the supply of water, it is not unseemly that attention should first be turned to the copious additions which have been made to our stores by the extraordinary rainfall which has made 1903 an *annus mirabilis* in meteorological records. At the close of 1901, we were about fifteen months in arrear in the matter of rainfall; and 1902 did not help us very much, if at all, to make up the deficiency. Looking at the position at the opening of the present year, we ventured to indulge the hope that the deprivation of rain from which the country had been suffering might be compensated for, to however small a degree, during the twelve months before us. That hope has been superabundantly gratified; for the year has surpassed all others since systematic records have been kept. In fact, it began with floods; and so extraordinary has been the downpour of rain, that it was deemed a worthy object of the wit of the Latin versifier in the Epilogue to the Westminster Play, who put into the mouth of one of the characters the plaint—"*totum annum pluvit, felibus et canibus.*" Up to the 29th of November, the rainfall recorded at the Meteorological Office at Brixton was 36·34 inches—a figure which had not been reached since 1824, when 36·3 inches were registered at the Greenwich Observatory. But by the middle of this month, it had gone up to 38 inches. These figures are unquestionably high; but what shall be said of 50·26 inches, which Gilbert White, the Selborne naturalist, tells us represented the rainfall in Hampshire in the year 1782-3? Coming back to our own time, it is rather curious that Essex, which suffered keenly from the absence of rain, felt the dire effects of a too liberal fall when it did come. The residents in the Thames Valley were in much the same case. Those who know the river will be able to form an idea of its swollen condition from the fact that a boating man sculled from Oxford to Richmond without troubling himself about the weirs—shooting them in perfect safety. Those who are not familiar with the stream may be interested to learn that the average flow of water in July and August was nearly six times greater than in the corresponding months of 1902. In the first-named month, the average daily flow was 1282 million gallons; in the second, 1115 millions. On the 25th of August, no less than 2135 million gallons of water passed over Teddington Weir after the London Companies had taken their supplies; while on the 24th of September, 663 million gallons—just about three times as much as was supplied to London daily during that month—were measured. The average daily flow was 892 million gallons. But this was a mere spoonful compared with the flow in October. It began with 1184 million gallons, and ended with 6419 millions. As the average daily supply in London during that month was 210½ million gallons, the bulk of water going over the weir on one day would have satisfied London's wants for about a month; while the last seven days' flow would have served, if it could all have been stored, for nearly half a year. November began with 6110 million gallons, and ended with 4487 millions; the total flow for the month being 96,522 million gallons, or an average of 3217 millions per day—nearly sufficient to fill the great reservoirs at Staines. Yet we are told that the Thames is being depleted by the excessive drafts upon it to meet London's requirements, and that our only security for a sufficient supply of water is to go to Wales for it!

Whether or not Wales will have to be resorted to, however, is a question which may be left to the Metropolitan Water Board, the constitution of which calls for notice as an event of the year of very conspicuous importance. After something like eighty years of agitation, about a score of Bills, three Royal Commissions, four Special Committees, and forty actions-at-law—to say nothing of such a trifle as the defeat of a Government—the Metropolitan Water Question was settled in the closing days of 1902 by the passing of a Bill for the constitution of a Board of 66 members, representative of various public bodies, to acquire the undertakings of the Water Companies and carry on their business. The purchase price was to be ascertained by arbitration; the Right Hon. Sir Edward Fry, Sir Hugh Owen, G.C.B., and Sir John Wolfe-Barry, K.C.B., being nominated Arbitrators. Early in March, they announced that their first sitting would be held on the 29th of May, and they issued all the necessary directions for the submission of the claims of the Companies and the answers of the Board thereto. After the customary preliminaries, the Board was duly formed, and held their first meeting on the 2nd of April, under the temporary chairmanship of Sir James Ritchie. Subsequently, however, Mr. R. M. Beachcroft was selected for the position; and Mr. W. Terrey, of Sheffield, was appointed Clerk. He, however, declined the office, and it was given to Mr. A. B. Pilling, the Town Clerk of Devonport. The Board had now got into working order, and the two parties to the great contest were brought face to face at the first sitting of the Arbitrators on the day fixed. At this the Companies' cases were considered, and amended claims were ordered; further proceedings being adjourned till the 26th of October. Meanwhile, the Board proceeded with the work of getting their business into shape, arranging Committees, and generally preparing for the arbitration. Inquiries were sent round to the Suburban Local Authorities to ascertain if they had any cause of complaint in regard to their supply; information was sought from water-supplying bodies; and all the necessary preliminaries were arranged to support the Board's case. By the middle of August, the answers to the amended claims of the East London and New River Companies—the two standing first for consideration—had been delivered; and then came the recess.

Quite early in October the Board resumed, with a constitution slightly altered, owing to deaths and resignations. Rumour said that things were not going altogether smoothly with the new body, and that there was rather too much of the Spring Gardens influence upon it. Certainly, the hostility to the Water Companies which was characteristic of the London County Council was by no means absent at the Water Board. This was evident from the preposterous offer made for the undertaking of the East London Company, in which the whole of the ordinary stock was excluded, while the New River Company were asked to accept about £8,500,000 less than the value they set upon their property. These two cases, therefore, presented good fields for the exercise of the judicial skill of the Arbitrators. Pending the commencement of their sittings, however, an important step was taken by the Board, in the acquisition by agreement of the undertakings of the Tottenham and Enfield Urban District Councils—in the case of the former for about £25,000 less, and in that of the latter for £55,000 less, than the sums claimed. Negotiations were also set on foot as to the portions of the undertakings which, under the Metropolis Water Act, 1902, would be transferred to the Local Authorities of Croydon, Richmond, Cheshunt, and Ware. The arbitration proceedings opened, as arranged, on the 26th of October, in the hall of the Institution of Mechanical Engineers, when the Arbitrators were faced by a formidable array of Counsel—Mr. Balfour Browne, K.C., leading for the Companies, and Mr. Fletcher Moulton, K.C., for the Water Board. The task before all the parties concerned was an arduous one, for against the Companies' claims of about £50,000,000 stood the Board's offer of only one-fifth of this amount. The East London Company's case was taken first, and occupied the Court till the 7th ult., when there was an adjournment for a week. It was resumed on the 16th, and continued till the 19th, when that of the New River Company was commenced. This case, owing to the Company being landowners as well as suppliers of water, was more difficult to deal with than its predecessor; and the result was that it occupied the Arbitrators till the 3rd inst.—the 24th day from the opening of the inquiry. During its progress, some highly important decisions, materially reducing the amount of the Company's claim, were given by the Arbitrators, some of which will be submitted to a strictly legal tribunal for final settlement. The Grand Junction and West Middlesex Companies' cases were next considered; and they occupied the Court up to the 21st inst., when the inquiry was adjourned till the 18th prox. The salient points in this gigantic arbitration will be so fresh in the recollection of most of our readers interested in water questions that they need not be referred to in detail. It should, however, be mentioned that the result of the Arbitrators' labours so far has been the disposal of four Companies' claims, and the making of awards in the cases of all but the New River Company. The amounts were given in the "Journal" last week.

Good progress has been made during the year with the

provision of new works or with the extension of those already existing for the supply of water. In London, the Staines reservoirs scheme, carried out by the Joint Committee of the Grand Junction, New River, and West Middlesex Water Companies, has now been practically completed, though it has not been brought into use. The works in connection therewith which are in course of construction by the New River Company have been pushed on; and so has the large storage reservoir which the Southwark and Vauxhall Company are building at Walton-on-Thames In June, the Directors and officials of the East London Water Company had the gratification of celebrating the completion of the two reservoirs, of a combined capacity of 1198 million gallons, which had been for some time in course of construction at Walthamstow, whereby the Company's storage capacity was about doubled. In the Provinces, the great scheme for the supply of Birmingham with water from Wales was further advanced; the expenditure upon it in the financial year ending the 31st of March last having been £458,300, bringing up the total outlay to £4,903,096. The Carlisle Corporation have decided to carry out the Geltsdale scheme for affording an additional supply of water to the city. A cause of some trouble was satisfactorily removed early in the year at Wolverhampton, by an agreement being entered into between the Corporation and Colonel Kenyon-Slaney for the payment of £10,000 in respect of compensation claimed by him for injury caused by their pumping operations at Cosford. The Huddersfield Corporation, however, were not quite so successful in relieving themselves of the difficulties attending the construction of their Blakeley and Butterley reservoirs, which have cost about £200,000 more than the estimate. They nevertheless resolved to try a change of Engineers, in the hope that these works may eventually be rendered thoroughly serviceable. The Corporation had the satisfaction of scoring a success, such as it was, in defeating the Bill of the Oldham Corporation for the purchase of the undertaking of the Deanhead Reservoir Commissioners, and the construction of additional works for utilizing a watershed over which they claimed a prior right.

A good deal has been accomplished during the year in the direction of generally improving the water supplies of towns. New water-works have been provided for Bude and Stratton, Burley-in-Wharfedale, Denton, Lydney, Margate, Padstow, Rothwell, and Woodbridge. New pumping-stations have been opened at St. Helens and Warrington; and a water-tower has been erected at Frinton-on-Sea by the Tendring Hundred Water Company. The Barnsley Corporation have completed their Midhope reservoir; and the Ipswich Corporation have formally opened one that was sanctioned in 1900. Additional storage schemes are in progress for Bradford, Buxton, Halifax, Rochdale, Torquay, and Warrington. Manchester has decided upon constructing a reservoir in Heaton Park, and is pushing on with the second pipe-line from Lake Thirlmere. Water schemes for Bolton, Daventry, Shrewsbury, and West Cumberland have been formulated; and extensions of various kinds carried out or put in hand at Birkenhead, Broadstairs, Bury, Goring, Kidderminster, Lincoln, Peterborough, Reading, Rugby, and Workington. A project has taken definite shape for improving the water supply of Guernsey; and the Caton Water-Works have been acquired by the Lunesdale Rural District Council. Last week the Aspatria, Silloth, and District Joint Water Board completed their scheme, commenced in 1901, for supplying their district with water from the Cumberland Hills. The Derwent Valley Water Board have proceeded steadily with their scheme during the year. It may be convenient to mention here that the number of these combinations of Local Authorities was increased last session by the constitution of the Irvine Water Board, consisting of representatives of the burghs of Saltcoats, Stevenston, and Kilwinning, for the administration of the water supply of the district.

Reference to the past session leads naturally to an indication of the course of water legislation during the year. It was not signalized by the sanctioning by Parliament of any scheme of very great magnitude; most of the measures being merely for extensions of works or of limits of supply. The Corporations of Bath, Bradford, and Torquay, and the Bury and District Joint Water Board, obtained power to construct additional reservoirs. Further powers were granted to the Belfast Commissioners, chiefly with respect to their scheme for supplying the city with water from the Mourne Mountains, for which £70,000 more money is required. The Sheffield Corporation are now in a position to construct a new pipe-line from Derbyshire to their Rivelin lower reservoir; and they have been permitted to arrange with the Derwent Valley Water Board to execute the works. An Act was obtained by the Corporation of Harrogate to enable them to acquire the Knaresborough Water-Works and afford a purer supply of water to the town. The Joint Water Committee consisting of representatives of the Leigh Corporation and the Hindley District Council has been dissolved; water being now obtained in bulk from the Liverpool Corporation, whose Water Engineer (Mr. Joseph Parry, M.Inst.C.E.) settled the terms under which the change was made. Extensions of area were sanctioned in the cases of the Merthyr Tydfil and New Hunstanton District Councils; while the Nelson Corporation were granted ten more years and £15,000 more money for the completion of a reservoir, conduit, and certain auxiliary works, for the construction of which they obtained the necessary power in 1888. Only one Water Company, strictly so-called—the Sutton District Company—was before Parliament during the past session; a Bill promoted for the constitution of a Company to construct works and supply water in a number of parishes in Sussex being withdrawn before the second reading stage was reached—another which shared a similar fate being that introduced to obtain authority for the formation of a Water Board for Kent. The Sutton Company obtained £150,000 more capital, one-half of which is to be applied to softening the water to a maximum hardness of 9°. The Winchester Water and Gas Company were granted £75,000 more capital and an extension of limits. The various contentious and other points arising on all these measures in passing through Parliament were duly noted at the time.

From the work of the Houses of Parliament we pass naturally to that of the Law Courts, which has in several respects been of considerable interest. Possibly the decision of most importance is that given by the House of Lords on the 14th inst., which limits the payment of back-dividends up to the maximum of 10 per cent., in the case of the Kent Water Company, to the year in which the Water-Works Clauses Act, 1847, was incorporated with one of their own—viz., 1864. The point in dispute came in the first instance before Mr. Justice Joyce in February, upon a motion for an injunction to restrain the Company from distributing their surplus profits in the way proposed; and it was decided adversely to them. They thereupon went to the Court of Appeal, where the Master of the Rolls and Lords Justices Romer and Cozens-Hardy, without calling upon the other side, unanimously supported the ruling of the Court below. The opinion of the highest tribunal was then sought, with no better fortune: the Lord Chancellor and five Law Lords all agreeing with the two previous decisions. The hearing of the final appeal had been accelerated for the purposes of the Court of Arbitration under the Metropolis Water Act, as upon the result of it depends the settlement of certain legal questions in abeyance. The Company were more successful in proceedings instituted by them to recover water-rates from the owner of a number of houses let on weekly or short tenancies. The amount in dispute was only £145. The question at issue here arose upon an agreement which the defendant declared was not binding upon him. The Court, however, decided to the contrary, and ordered him to pay the amount claimed, with costs. The House of Lords, just before rising in August, gave judgment in an appeal from a decision of the Court of Appeal, reversing one given in the King's Bench Division by Justices Ridley and Phillimore earlier in the year. The question turned upon the amount to be paid as compensation by the Pontypridd Water Company to the Bwllfa and Merthyr Dare Steam Colliery Company in respect of a certain seam of coal which, for the safety of their reservoir, it was desirable should not be worked; and the difficulty was to decide whether a rise in the value of coal which had taken place after the Company's notice to treat, and before the award of the Arbitrator, should be considered by him in fixing the sum. Their Lordships were of opinion that it should; and they accordingly affirmed the judgment of the Divisional Court. A somewhat similar case was decided by their Lordships on the 7th inst., in which the Clippens Oil Company appealed against an interdict forbidding the working of certain minerals in such a way as might be detrimental to the safety of a water-pipe belonging to the Edinburgh and District Water Trust. Here the Company failed in their appeal; as did also the Rhymney and Aber

Valleys Gas and Water Company in theirs from a verdict and judgment by Mr. Justice Phillimore and a Common Jury at Glamorgan, in a case which raised the point whether a person who is entitled to demand a supply of water can, in the event of its being refused, bring an action for an injunction and damages, or whether he is bound to sue for penalties. His Lordship had granted the injunction; and the Court of Appeal supported his decision.

Several cases raising other points may be briefly alluded to. The Hastings Corporation got into trouble with the Contractors for their water-works in the Brede Valley, and the latter obtained an injunction against the Corporation to restrain them from entering into possession of certain works in course of erection, until an award had been made upon questions in dispute. A little difficulty arose between the Llandrindod Wells Water Company and the Arbitrators and Umpire appointed in connection with the transfer of their undertaking to the Urban District Council, in regard to the fees charged: with the result that they recovered £102 7s. 6d. The Corporation of Huddersfield made themselves liable for penalties for neglecting to supply compensation water; and the question arose as to whether these should be recovered summarily or by action in the High Court. Mr. Justice Wright said the latter; and the Court of Appeal confirmed his *dictum*, with costs against the Corporation. At Wilmslow, a consumer who declined to pay his rate on the ground that the quality of the water supplied was not good, learnt that by so doing he was taking the wrong course for redressing his grievance. A decision of the Brentwood Magistrates, ordering the payment to the South Essex Water Company of rent in respect of a structure which they declared to be a "water-closet," though no water had been supplied to it, was reversed on appeal. An attempt was made to punish the Tendring Hundred Water Company for refusing, on the ground of deficient machinery, to supply an electricity generating station at Walton-on-the-Naze; but the summons taken out against them was dismissed. The East London Water Company, on the other hand, had to pay 1s. and £10 10s. costs, as well as to submit to a snub from the Magistrate, for cutting off a consumer's supply in an arbitrary manner. An interesting case arose at Crediton, where the Urban District Council claimed from the owners of certain cottage property, of less than £10 annual value, arrears of water-rents extending back for several years. The claim was resisted on the grounds that no agreement had been made with the defendants for the supply of water, and that the action should have been taken within six months. The Judge held that there was evidence of an agreement to pay the rent; and he gave judgment for the Council for the amount of their claim during the six years immediately prior to the commencement of the proceedings. Apart from the London Water Companies, already dealt with, several arbitrations have been held during the year. The proceedings to determine the price to be paid by the Corporation of Devonport for the undertaking of the Devonport Water Company took place in April before the late Sir Frederick Bramwell and Messrs. Hawksley and Hill, and were reopened in July to hear further evidence. A difficulty has arisen in this matter owing to the death of the Umpire before he had made his award. The Bradford, Leeds, and Tynemouth Corporations and the Rushden and Higham Ferrers Water Board were engaged in arbitrations in respect of land required for the purposes of their works. The last-named Corporation and the landowners concerned had to resort to the King's Bench Division to have their respective claims adjusted. The Aspatria and Silloth Joint Water Board and Miss Gough had to take a similar course in connection with the settlement of the amount to be paid to the lady in respect of her land and water rights.

Regarded from the technical and administrative standpoints, the water questions of the year have been by no means lacking in interest. The selection of Mr. Charles Hawksley as President of the Engineering Section of the British Association was a guarantee that water topics would not be overlooked at the meeting of that body at Southport. Indeed, his long address to the section was devoted mainly to the branch of engineering with which the name he bears has for so many years been associated. Mr. Joseph Parry and Dr. J. Campbell Brown—the former the Water Engineer, and the latter the Public Analyst, of Liverpool—read interesting papers. Mr. Parry dealt with the subject of the afforestation of the catchment areas of water-works, upon which he must be regarded as an authority. At the Engineering Conference in July, Mr. Percy Griffith, the Secretary of the British Association of Water-Works Engineers, brought under notice the process of raising water by compressed air; and Sir Alexander Binnie emphasized the importance of systematically kept rainfall records. The Association just referred to held two good meetings—one at Bolton and the other in London—under the presidency of Mr. R. H. Swindlehurst, who delivered at the former an instructive address. On each occasion, the technical matter presented was of excellent quality, and it will form a valuable addition to the Transactions. At the annual congress of the Sanitary Institute in Bradford, a plea was once more put forward for the establishment of a Central Health Authority. This question, as well as that of river pollution and the protection of sources of water, was also brought into prominence in the third report of the Royal Commission on Sewage Disposal issued in March. That some definite steps should be taken in connection with all these matters is a conclusion which is gradually being much more widely accepted. In the meantime, the Bristol Water Company have framed a set of bye-laws by which they hope to secure their sources from contamination. The question of polluted water supply and the production of typhoid fever occupied serious attention in Belfast, on the publication of a rather alarming report presented to the Public Health Committee of the Corporation by Professor J. Lorraine Smith. The shocking condition of some village water supplies in Yorkshire was made manifest in a report by Dr. S. W. Wheaton to the Local Government Board.

Among the minor events of the year which call for notice is the completion of the constant supply of water, in accordance with the Metropolis Water Act, 1871, in the whole of the County of London, with the exception of Sydenham and certain places situated above the statutory height. In order that this boon may be fully enjoyed by the consumer without detriment to the supplier, the fittings must be in good order. The action of the Plumbers' Company, therefore, in convening a conference on the subject of the training and registration of plumbers and the standardizing of fittings, and in seeking the co-operation of the British Association of Water-Works Engineers and other bodies specially interested, with the view of securing better and more uniform work, is to be much commended. While on the subject of plumbing, it may not be out of place to mention that a valuable report upon moorland water and lead poisoning, by Dr. A. C. Houston, was issued by the Local Government Board in February, and that a fatal case of lead poisoning occurred at Dewsbury early this month. The quality of the Gosport Water Company's supply has been much complained of all through the year, with the result that the undertaking may possibly pass into the hands of the District Council. At Torquay, on the contrary, Dr. Percy Frankland was able to present to the Town Council in June a most satisfactory report on their works and supply. The Cambridge Water Company attained their Jubilee in June.

A few personal matters will close our record of the year's doings. Mr. W. Ingham left the service of the Torquay Corporation to take the position of Hydraulic Engineer at Port Elizabeth (South Africa), and was succeeded by Mr. S. C. Chapman. Mr. Harry Francis, who had been Engineer of the Devonport Water-Works for many years, relinquished the position, and Mr. F. W. Lillicrap, of Plymouth, was appointed in his stead. Mr. Albert Latham gave up the post of Borough Surveyor of Margate in order to devote his attention to the new water scheme of the Corporation. Mr. G. H. Hill was appointed to complete the Blakeley and Butterley reservoirs of the Huddersfield Corporation. The special services rendered to the Ipswich Corporation by Mr. Hamlet Roberts were recognized by a liberal vote of money; and Mr. James Mansergh had conferred upon him the freedom of Lancaster, his native town. Mr. J. R. Sutherland succeeded at Glasgow Mr. J. M. Gale, who did not live many months to enjoy his retirement. In addition to Mr. Gale, there were removed during the year by death Sir Frederick Bramwell, the Duke of Richmond, Dr. Corfield—all very closely associated with water supply—Mr. H. W. Pearson, the Engineer of the Bristol Water-Works (whose successor is Mr. J. A. MacPherson), Mr. H. Barrett, the Secretary and Manager of the North Cheshire Water Company, Sir Allen Lanyon Sarle, the Chairman of the Sutton Water Company, and Mr. W. Blaber, who succeeded him in the office.

Arbitrariness at the L.G.B.

THE description of a new reservoir that has been built for the Hoylake and West Kirby Water Company supplied the subject for the second paper at the winter meeting of the British Association of Water-Works Engineers. It was by Mr. Alfred J. Jenkins, now of Jersey, and is a useful contribution to have on record in regard to what is recognized on all hands among water engineers as the excellent modern and economical method of blending steel and concrete in reservoir construction. It was this that gave the discussion a vehement turn into an unexpected channel. There was no criticism of the system itself. It was the despotic attitude in regard to it of the authorities at the Local Government Board that gave the key to what was nothing short of an outburst of indignation on the part of engineers representing various municipal bodies. Water companies are—and they are thankful for it—exempt from the arbitrary whims in such matters of the Board or their inspectors; and they can adopt whatever appears to them to be the fittest form of construction. Not so those municipal authorities who have to appeal to the Board for sanction to schemes and the grant of loans for their execution. Speaker after speaker in the discussion told of plans returned, and loans refused, where steel and concrete work was proposed for reservoirs; while another spoke of the vengeance of the Board being visited on authorities who broke through the Board's ancient prejudices by a shortening of the time for the prepayment of loans in the case of steel and concrete work. Circular reservoirs, too, are objected to in Whitehall; but for what reason no one can divine who is not admitted to the inner secrets of that remarkable body.

The allegation of arbitrariness in these matters appertaining to modern engineering practice is well founded, seeing that two speakers were able to advance specific instances of circular reservoirs being allowed; and one gave a case of steel and concrete reservoir construction. The question naturally arises, who is responsible for such antagonistic ruling? The position points to the want of some supreme authority over the acts of the inspectors. It is they apparently who inharmoniously dispense authority according to their individual taste and will. The inspectors may deny this, and shelter themselves (as it is asserted they do) behind "the Board," whose very existence is beginning to be disbelieved. Were there some controlling power over the doings of these individuals, there could not possibly be the incongruity that now obtains. If, in the circumstances, there are charges against the inspectors of being old-fashioned, behind the times, and wanting in practical experience of modern engineering work, who can wonder? Economical construction ought not to be allowed to be hindered in this manner by the ignorance or whims of persons; and it is to be hoped that the protest of the practical men who spoke on Mr. Jenkins's paper will find its way to the proper quarter, for it is plain that here is a state of things that calls for some immediate correction.

The late Sir C. Nicholson.—In the "JOURNAL" for the 17th ult., we recorded the death of Sir Charles Nicholson, one of the original Directors of the Australian Gaslight Company. The deceased baronet left estate valued at £87,810.

Gas for Driving Electric Light Plant.—In the "JOURNAL" for the 13th of October, we gave some particulars, reproduced from "Engineering," of the gas-driven electric light plant at Tunis. It may be remembered that it was supplied by Messrs. J. & O. G. Pierson, of Paris, by whose producer the gas is made. This apparatus, which is of the suction type, has but recently been described and illustrated in our contemporary; and the following are the advantages claimed for it: (1) It can be fed with any hard coal (not anthracite) containing up to 10 or 12 per cent. of ash, and as much volatile matter. (2) The engine can be started from cold in less than 10 minutes. (3) Thorough cooling, scrubbing, and cleaning of the gas is secured, which allows the engine to work for a considerable time without cleaning. (4) Coal is fed in only once every 10 or 12 hours, so that there is no attendance except for stirring the fire, which is entirely open. (5) The automatic regulation of the admission of vapour to the fire is easy, and allows the plant to be run at varying loads without any trouble. The action of the producer is as follows: At each suction stroke of the engine, a certain amount of air and aqueous vapour is drawn into the fire, and combines with the coal to make a mixture of carbon monoxide and hydrogen, in association with nitrogen. The gases, after being cleaned, are mixed with the necessary quantity of air in the engine, and are ignited in the ordinary way.

ESSAYS AND REVIEWS.

LOCAL ADMINISTRATION AND TAXATION.

THE Thirty-Second Annual Report of the Local Government Board, containing particulars of the work of the Department for the year 1902-3, has lately been issued; and, as on previous occasions, we reproduce from it some of the statistics relating to local administration and taxation. The mass of matter here presented, filling nearly a thousand pages, does not cover the whole of the Board's work, as a separate, and almost equally bulky, volume is devoted to the proceedings of the Medical Department. With regard to the Blue-Book just published, the various subjects are, as usual, arranged in five groups: The work of County Councils under the Local Government Act, 1888; proceedings under the Local Government Act, 1894; the relief of the poor; the public health and local administration; and local taxation and valuation. It is with the statistics contained in the last two groups that our readers are specially concerned.

In the course of the past year, the Board issued 68 Provisional Orders under the Public Health Act, 1875, one under the Gas and Water Works Facilities Acts, 1870 and 1873, and three under the Local Government Act, 1899. Some of these Orders conferred additional powers on local authorities in regard to their gas and water undertakings, including the acquisition and use of additional lands for the manufacture and storage of gas, the supply of gas and apparatus, &c., used in the consumption of gas for lighting and heating or other purposes, the amendment of provisions as to the price of gas, the extension of the limits of supply of gas and water, and other matters. The Order granted to the Barry Urban District Council enabled them to carry the whole of the surplus revenue of their gas and water undertakings to the district fund, instead of applying one-half of it in reduction of the gas and water charges. The Atherton Urban District Council were granted additional borrowing powers to the amount of £50,000 in respect of their gas undertaking; the Hindley Town Council, to the extent of £25,000; and the Ramsgate Corporation of £50,000. The St. Helens and Stratford-upon-Avon Corporations were allowed to raise "such sums as may be necessary" for their gas undertakings. Barnsley obtained £120,000, Darlington £50,000, Southampton £50,000, and Cardiff, Cirencester, and Swindon whatever was necessary, in respect of the water-works. Our readers may possibly remember that, by section 62 of the Public Health Act, 1875, a district council may apply to the Board to determine the reasonable cost at which water may be required to be furnished to houses without a proper supply; and the Board are empowered, by section 8 of the Public Health (Water) Act, 1878, to fix a general scale of charges for the whole or any part of a council's district. Three of these scales were fixed last year for the Rural District Councils of Blean, Chorley, and Knaresborough, in respect of certain contributory places. Under section 3 of the last-named Act, the Board are empowered, on the application of a local authority, to determine the reasonable cost of providing an available supply of wholesome water sufficient for the consumption and use for domestic purposes of the inmates of any particular dwelling-house. In one instance last year, on the application of the Misterton Rural District Council, the Board issued an Order in respect of a house in the parish of Walkeringham.

In addition to the local inquiries conducted by the Engineering Inspectors of the Board with regard to applications made under the Local Government Acts of 1888 and 1894, and the Municipal Corporations Act, 1882, others were directed in 1033 cases. The majority of them had reference to applications from sanitary authorities for sanction to the borrowing of money for carrying out works of a permanent character under the provisions of the Public Health Act, 1875, the Electric Lighting Act, 1882, the Public Health (London) Act, 1891, and others. Of the above-named total, 48 related to petitions for the issue of Provisional Orders under the 1875 Act and the Gas and Water Works Facilities Act, 1870. The Board gave their consent to the institution of proceedings, under the Rivers Pollution Prevention Acts, by the West Riding of Yorkshire Rivers Board against certain manufacturers, in respect of the pollution of rivers and streams. The approval of the Board in regard to matters within their jurisdiction was given, under section 4 of the Borough Funds Act, 1872, to the resolutions of 53 corporations and urban district councils to promote 46 Local Bills in Parliament in the session of 1902, and of 43 of these bodies to oppose 37 of such Bills. During the year, the Board made reports to Parliament on 122 Private Bills, of which 57 were promoted by local authorities and 65 by companies or other authorities. In ten cases the Board found it necessary to present supplementary reports, in consequence of alterations made in the Bills while passing through Parliament. Appended to the report is a list of the Acts obtained last year by local authorities and by gas and water companies in England and Wales, exclusive of the Metropolis.

Taking financial matters next, the report records that the Board sanctioned in the year dealt with the borrowing of £11,466,647 by urban and rural authorities, compared with £13,291,828 and £10,829,747 in the two preceding years. The former authorities required £488,593 for water supply and £1,955,175

for sewerage and sewage disposal, and the latter £193,036 and £432,797 respectively; while joint boards needed £13,500 and £28,327 for carrying out work for these purposes. In 1901, the joint boards borrowed £77,632 for water supply, against the insignificant sum of £1108 in 1900. The large amount required two years ago furnishes striking evidence of the extent of the work of these organizations. Since the constitution of the Local Government Board in 1871, they have sanctioned the raising of no less than £137,749,539—beginning with £267,562, and rising to £13,291,828 (in 1901-2); and during this period £131,019,287 has been granted by Parliament. Detailed information with respect to all the loans authorized by the Board during the past year—their purposes, the authorities by whom they were to be raised, and the number of years allowed for their repayment—is, as usual, furnished in tabular form in one of the appendices. The following amounts were required for gas undertakings: Aberavon, £11,767; Birstal, £2350; Blackpool, £14,600; Burnley, £4800; Buxton, £13,000; Darlington, £23,852; Evesham, £1103; Fenton, £6000; Gainsborough (for gas stoves and cookers), £1500; Goole, £14,874; Keighley, £24,779; Malvern, £6400; Neath, £5500; Nelson, £23,000; New Mills, £2500; Newton-in-Makerfield, £11,627; Ramsgate, £9500; Rhyl, £6581; Saffron Walden, £1550; Sandwich, £2108; Sedgley, £1120; Shoeburyness, £15,342; Silsden, £6715; South Molton, £1740; Stafford, £6320; Stourbridge, £5000; Stratford-on-Avon, £5332; Swadlincote, £21,711; Tipton, £1850; Tyldesley-with-Shakerley, £6281; Wombwell, £4841; and Yeovil, £6000. Several loans of small sums were also granted for gas-works purposes. The following were the most important amounts sanctioned for water undertakings: Barnsley, £113.422; Croydon, £10,000; Exeter, £13,000; Halifax, £10,000; Hastings, £28,088; Ipswich, £29,470; Milton-next-Sittingbourne, £12,000; Newton-in-Makerfield, £21,172; Plymouth, £20,177; and Southampton, £18,910. For purposes of electric lighting, urban authorities were empowered to raise £2,736,673 last year. Under the Public Health Act, 1875, the Board recommended the Public Works Loan Commissioners to make advances amounting to £131,375 to local authorities. Of this total, £113,947 was required by town and urban councils, £16,568 by rural councils, and £860 by a joint board.

The accounts of 810 urban district councils and their officers for the year ending March 31, 1902, were checked by the District Auditors of the Board, as were also those of 672 rural district councils, 92 joint boards for sanitary purposes, and 240 joint committees appointed wholly or in part by district councils. In the twelve months ending Dec. 31, 1902, the Auditors made 525 disallowances and surcharges in the accounts of the urban councils and their officers, 9 in those of gas and water boards, and 334 in those of rural councils. Many of these were appealed against; and the Board decided 309 in the first group, 2 in the second, and 99 in the third. The accounts of 6739 parish councils, 398 parish meetings for places not having councils, and 90 joint committees of these authorities, were also gone over by the District Auditors; the audit in each case including the accounts of the officers. There were altogether 204 disallowances and surcharges; and the Board decided appeals in regard to 123 of them. Audits of the accounts of the Councils of the Metropolitan Boroughs and their officers for the twelve months ending March 31, 1902, were held, and 89 sums were disallowed or surcharged. Appeals relating to 11 of them were decided by the Board. Particulars of the appeals and of the Board's decisions thereon are given in an appendix.

The section of the report dealing with local taxation and valuation is a very instructive one. It sets forth that the Board prepared and presented to Parliament returns showing the receipts, expenditure, and outstanding loans of the various local authorities of England and Wales for the financial year 1900-1901. They include summaries of the accounts of about 28,500 local authorities, compared with 28,700 and 29,500 for the two immediately preceding years. An epitome of the statistics given in one of the appendices shows that the aggregate receipts, excluding loans, were £81,985,528, of which £12,656,393 was the proceeds of Imperial taxation. Including the loans (£29,931,138), the total receipts amounted to £111,916,666, comprising £6,859,302 from gas-rentals, £3,892,117 from water-rates, &c., and £1,271,796 from the supply of electricity. The figures for the preceding year were: Gas, £6,035,526; water, £3,730,219; electricity, £910,329. Of the grand total, 38·4 per cent. was derived from public rates; 11·3 per cent. from grants and other receipts from Imperial taxation; and 12·5 per cent. from gas, electricity, water, and tramway undertakings. The aggregate expenditure amounted to £110,384,912, of which £16,872,740, or 15·3 per cent., was devoted to the repayment of borrowed moneys and the payment of interest thereon. Other large items of expenditure were £7,075,232 for gas-works, £4,475,825 for water-works, £4,255,787 for electric lighting, and £4,329,984 for sewerage and sewage disposal. The outstanding loans of the local authorities at the close of the financial year under notice amounted to £316,704,222, of which £145,813,771, or 46 per cent., had been borrowed for the purposes of undertakings which are or may be reproductive—such as gas and water works, electric lighting plant, tramways, &c. The outstanding loans on gas-works at the date named amounted to £20,780,816, on water-works to £56,255,336, and on electric light undertakings to £11,065,916. Of these amounts, £1,264,009 was raised for gas, £3,443,286 for water, and £3,364,846 for electric lighting, in the course of the year.

One of the most interesting tables in the book is that which shows the total amounts received by local authorities from the public rates, Imperial taxation, loans, and other sources, from 1874-5 to 1900-1901 inclusive. In the first-named year, the receipts from the public rates came to £19,198,579; in 1880-1, they were £22,907,790; in 1890-1, they were £27,818,642; and in 1900-1901, they reached £42,993,668. The increase is £23,795,089, or at the rate of 123·9 per cent. During the period named, the sums received by the local authorities out of the proceeds of Imperial taxation (including sums received out of the local taxation account) rose from £1,681,399 to £12,660,942; being an increase of £10,979,543, or 653 per cent., or excluding £1,329,588 received under the Agricultural Rates Act, 1896, an increase of £9,649,955, or 573·9 per cent. The amount annually obtained by means of loans has increased rapidly of late years; that raised in the year of 1900-1901 being much greater than in any of the 26 years comprised in the table. The total receipts by the local authorities of England and Wales during the year just named were more than twice as great as the corresponding total for 1888-9. Special attention is again directed to the fact that much of the increase in the rates to which reference has been made above is attributable to the legislation which took place immediately before or during the period comprised in the table. The rise in the amount of rates raised to meet the expenditure of School Boards (now being abolished under the Education Act, 1902) is particularly noticeable; the sum so raised in 1874-5 being £373,859, and £5,622,005 in 1900-1901, exclusive of £107,247, the amount of the grants paid in the latter year under the Agricultural Rates Act. The average amount of public rates raised per head of the estimated population of England and Wales in 1874-5 was 16s. 2d.; whereas in 1900-1901 it was 26s. 8d.—just half-a-guinea more. The outstanding loans averaged £3 18s. 3d. in the former year; while in the latter they were £9 16s. 5d. With these striking figures we will close our notice of this bulky but very interesting report.

MUNICIPAL DEPRECIATION FUNDS.

MUNICIPAL traders can so seldom be brought to see the necessity of conducting their undertakings on ordinary business lines, that it is not surprising to find the Plymouth Corporation deliberately rejecting a resolution in favour of the establishment of reserve or depreciation funds.

More than a year ago, the Corporation were warned by their responsible officials that the electric tramways will have a short life, and that in five years most of the lines will need to be renewed. The plant at the electricity works also will not endure for anything like the period for which the money has been borrowed; and there are other undertakings in which prudent men would make provision for the inevitable depreciation. As a beginning, the Borough Treasurer and his engineering colleagues suggested that the sum of £5000 should be set aside annually as a depreciation fund in connection with the Tramways and Electricity Departments; but nothing has yet been done in the matter. There is no one—as one of the members pointed out at the last meeting of the Council—to compel the Corporation to have a reserve fund; and no party is bold enough to go before the ratepayers with a proposal to add 2d. or 3d. to the rates in order that provision may be made for the future. The truth is that supporters of municipal trading cannot be brought to admit, except under the stress of actual calamity, that the businesses which were to bring relief to the rates are in fact being conducted at a loss.

The proposal before the Council was in the form of a resolution instructing the Committee in charge of a Bill which the Corporation have given notice to promote, to insert clauses making it obligatory that a reserve or depreciation fund shall be set aside and invested annually in such amounts as the Local Government Board, or other sanctioning authority, shall approve. This proposal follows the recommendations of the Repayment of Loans Committee of 1902, and is not open to the objection which is sometimes urged against Government audits, that it restricts the liberty of corporations or lowers their dignity. It is obviously a very proper provision in the interests alike of present and future ratepayers. But objection was taken to it on several grounds. It was urged, on the one hand, that it was undesirable to adopt a new principle by asking Parliament to make depreciation funds compulsory. No other corporation in the country, it was said, had made a similar request; and until it was forced upon the town by the general law, there was no reason why they should curtail their rights and privileges. Municipalities, it was contended, could be trusted to do what was right and proper in this and other matters.

It must be admitted, however, that if depreciation funds are right and proper, municipalities are in no hurry to form them. One of the leading opponents of the resolution said that he had taken the trouble to inquire what other corporations were doing; and he found that only eleven had formed depreciation funds, and invariably these were provided out of profits. The rule, therefore, would seem to be "No profit, no depreciation fund," and, pretty often, no depreciation fund whether a profit is made or not. "Take care of the present and let the future go hang," is a maxim which in commerce points the way to the Bankruptcy Court; and in the case of municipal undertakings, it is certain to lead to disillusionment and bitter disappointment. In the case of Plymouth, the lesson promises to be speedy and severe.

LABOUR TROUBLES IN THE AMERICAN COAL-FIELDS.

THE advices which are coming to hand regarding the unsettled labour conditions in connection with the anthracite coalfields of Pennsylvania, will cause some surprise to those who imagined that the agreement which followed last year's struggle had finally set at rest all matters of dispute between masters and men. It is now said that everything points to another, and far more serious, strike when the present agreement terminates, as both parties are dissatisfied with the award. The employers are under the impression that they are paying too high wages; while the men allege that members of the Union who were active in the last strike are discharged upon every pretext. Considering the enormous amount of injury that the last strike caused, the suggestion that an even worse one is looming in the distance—even though it may still be some way off—is, to say the least, very disturbing. Some comfort may, however, be derived from the fact that there are indications that the masters and the railway companies do not intend to be caught if they can help it; for it is rumoured that at the present time huge quantities of coal are being put into stock, so as to be available in case of a stoppage.

In view of the renewed attention which thus seems likely to be attracted to these coalfields, it may not be uninteresting to recall some of the principal features of the last disastrous quarrel, a good outline of which will be found in a communication made to "Cassier's Magazine" by the late Dr. Robert H. Thurston—and which, by the way, our contemporary says is probably the last article written by him for publication. Some idea of the effects of the struggle may be arrived at, when it is mentioned that for five months there was an entire cessation of coal mining in the anthracite districts of Pennsylvania. The direct loss to the mine owners, the employees, and the transport companies was estimated at not less than one hundred million dollars; while it is, of course, impossible to compute the damage that was caused indirectly to the trade of the country. The declaration of the strike deprived of work some 140,000 members of the Union, besides forcing out of employment practically all other miners and destroying the business of nearly every industry in the anthracite coal region. There were many points of dispute between the parties—the miners claiming, among other things, shorter working hours, better pay, both for day work and contract work, a better arrangement regarding the measurement of the product of the day's labour, and the recognition of the Union. The employers, on the other hand, asserted that it was, as a matter of business, impracticable to give higher wages, to establish a shorter working day, or to modify in any important degree the methods or details of working. They also said that it was impossible to officially recognize the Union, composed as it was mainly of men whose work lay outside the anthracite fields, and who were therefore entirely ignorant of the conditions existing there. It was alleged that the influence of the Union had been wholly bad, and that it had already become impossible to maintain essential discipline and to carry on the business in a satisfactory and profitable manner. In the end, however, it was mutually agreed to submit the whole matter to arbitration; and a Commission was appointed for the purpose of considering the matter. The report of this Commission (which was drawn up after receiving the testimony of all available witnesses, and hearing the arguments of Counsel representing both parties) covered all the questions raised. It was decided that it would be right to raise somewhat the wages paid in the coalfields, to shorten in some cases the length of the working day, and to adopt in others a sliding-scale of payment for coal produced, basing this scale upon the prices obtained for the coal in New York harbour. The Commission also provided for the formation of a Conciliation Board to settle disputes that might occur later, and that the agreements made under the award should hold good until 1906.

The New Retort-House Plant at Hull.—We are asked to state (in reference to a paragraph sent for publication in the "JOURNAL" for the 1st inst., p. 550) that "the contract—beyond the charger and discharger—provides for gas-motors for the coal elevators and conveyors and the coke-conveyors."

Gases Escaping in Sulphuric Acid Manufacture.—At the last meeting of the Nottingham Section of the Society of Chemical Industry, Mr. H. J. Watson read a paper entitled "Examination of the Methods employed in Estimating the Total Acidity of Gases Escaping from the Chamber Process for the Manufacture of Sulphuric Acid." In the course of it, he remarked that in estimating the total acidity of chamber escape gases, hydrogen peroxide is the absorbent most usually adopted; but one of the Inspectors under the Alkali Works Acts has pointed out that higher results are obtained with a mixture of sodium hydrate and hydrogen peroxide. The results of his experiments were given in a paper read before the London Section of the Society in December last year; and they are confirmed by those given by Mr. Watson. By adopting a new method for the use of hydrogen peroxide and sodium hydrate, higher results have been obtained than by the ordinary method of mixing the reagents. It is also shown that sodium hydrate alone as absorbent gives higher results than hydrogen peroxide alone.

ELECTRIC LIGHTING MEMORANDA.

A Retrospect of 1903.

THE history of the electric lighting industry for the past year is full of incident, but within limits. In the United Kingdom, the main line of progress of the industry lay in the direction of the emancipation of electricity supply from the parochialism which was so characteristic of the Electric Lighting Acts. Considerable advance was made towards the experimental proof of the idea of the bulk generation and distribution of electric power by large companies; so that there is good reason to hope that the presumption on which such undertakings rest will be tested on an adequate scale before another year has run its course. During the past twelve months some large municipal electricity supply undertakings paid the "bulk" schemes the compliment of imitation in advance, by branching out into tramway traction business at low rates, and by offering electric power for all purposes at prices as low as 1d. per unit. Though some British Gas Companies have statutory powers to apply for Electric Lighting Orders, they have not done so; and the only English Gas Company possessed of an electric power business—the Walker and Wallsend Company—parted with it. More bulk schemes of electric power supply are in the air; and it is confidently expected that many local authorities whose ventures in this line have been unprofitable, will be glad to find work for these companies. A beginning has been made by the Willesden and Watford Urban District Councils, who agreed to dispose of their electric lighting undertakings to a large Power Company.

Trade in the electrical engineering line has been depressed throughout the year, owing to the powers of production exceeding the demand. The well-known firm of Ferranti went into the hands of a Receiver; and the capital stocks of many of the companies in the same business fell to 50 per cent. discount. This dulness was due to the circumstance that the plant required for electric tramways had chiefly been supplied, and there was a scarcity of further orders. No actual progress has been made in the application of electric traction to full-sized railways. The German manufacturers of electrical machinery who had overstocked the markets of the world, were obliged to settle down to such diminished employment as came their way. Absolutely no great invention appeared to attract new business. The lamp branch of the electrical industry, at home and abroad, was not revived by any novelty. Several arc lamps of the "flaming" type were put upon the market as rivals of the "Bremer;" but they did not revolutionize the industry. The same may be said with equal truth of the Nernst lamp, which came into increased use for shop lighting. Though this lamp boasts of double the efficiency—in light afforded for current consumed—of the carbon incandescent lamp, the circumstance of its being quite useless for illuminating powers of below 35 to 40 candles makes the consumption per point the same as with the older system.

The importance of house wiring for electric lighting was generally recognized; and though a Bill which was intended to enable the Metropolitan Boroughs doing electric lighting to spend public money on the wiring of houses was rejected, everywhere the same object was sought after in various ways. Probably this year may be noted as the first during which speculative builders of dwelling-houses in suburban districts largely followed the practice of leaving out the gas-pipes, and wiring for the electric light instead. The usual vagaries were exhibited as regards charging for electricity supplies for private lighting, though it was believed that the old-fashioned, simple plan of the "flat rate" gained somewhat in public favour. The direct-current system of generation, with three-wire distribution, is most in favour for general town services, the pressure being raised to as much as 240 volts in the newest examples. This is hard on the lamps. Whatever advantages of a general character the consumer of current may have gained from these high voltages, he has been unable to procure 16-candle lamps to run 1000 hours at an efficiency of 4 watts. The leakage in the distributing systems is also high, being as much as 30 per cent. in some glaring examples.

Among the delusions fostered by speculative electricians which are dying hard, but nevertheless went some way towards their end during the year, was the belief in rubbish destruction as a means of cheapening electricity generation. Several damaging exposures of the real result of combinations of this nature were made, and judgment was allowed to go against them. Though a good deal was said in various quarters about the cheapness of producer-gas power for generating electricity on the largest scale, very little, if anything, was effected in this sense. The truth is, as several eminent engineers have pointed out, that the proportionate importance of the cost of fuel in electricity generation is rarely so great as to invite costly experimentation with a view to its reduction. The history of storage batteries was not much more than rippled on the surface by the publication of statements of the performance of the Edison invention in this kind, which does not seem to be anything very great, and even so is best adapted to the purposes of locomotion. In many English towns a business is done in isolated electric lighting and power supply, suitable also for the charging of batteries of electromobiles, by the use of small and medium-sized gas-engines consuming ordinary coal gas. Some gas companies have statutory power to hire out engines and dynamos for this purpose, which may yet

prove the most acceptable solution of the problem of providing a little electric light where there is no paying demand for a large quantity of it.

The folly of the craze for municipal electric light was very strongly exhibited by the misfortunes of Marylebone, which had insisted on acquiring, by severance from the Metropolitan Electric Supply Company, the section of their undertaking in the borough limits. The result of the arbitration to determine the price to be paid for this portion was an award to the Company of £1,212,000 for their property. To this was added £70,000, the costs of the arbitration proceedings, and £100,000 additional capital expended by the Company in the district since 1901, which was the account year. As there was no generating station included in the purchase, the Borough Council would have to buy current in bulk from the Company at a profit price, or lay out another half-million upon a station and site. Altogether, the capital commitment of the Council under the scheme would be some £2,000,000. When the Council proceeded to take the preliminary steps to raise this sum, it was discovered that statutory power to do so was wanting. Meanwhile, the Company obtained an order of the High Court for specific performance, and the date fixed was the 31st inst. Quite recently, however, the Court has deferred the time to Feb. 29 on terms, which will require the immediate raising of a rate of 9d. in the pound. The Council are promoting a Bill to enable them to borrow the £2,000,000, which would entail an annual charge estimated at £105,800. The annual net profit of the undertaking is not more than £55,000; so that the ratepayers would lose £50,000 a year certain for the luxury of having "municipal" electric light.

A sign of the times was the cessation of the supply of electric light in the town of St. Austell, Cornwall, by the local Company, after a struggle of many years. We believe that this is the first instance of a modern undertaking of the kind giving up business, since the historic Brush collapse. The St. Austell and District Electric Lighting and Power Company, Limited—to give it its full title—took over in 1900 an undertaking which had been established for some years previously by a local firm. The town is exceedingly compact, and for a time the venture appeared to enjoy a considerable amount of patronage. Originally the supply was charged for at a rental of 1s. per candle power nominal per annum; but a meter system was introduced. This was probably a specific case of incandescent gas at popular prices killing the electric light after fair competition; the price of gas, owing to local conditions, being 4s. 2d. per 1000 cubic feet. Doubtless, a few years ago, the electric lighting would have been taken over by the Local Authority; but in this case experience gained elsewhere has evidently availed to save the ratepayers' pockets. In connection with this latter consideration, a good deal of discussion arose with respect to the question of the solvency of those municipal electric light undertakings which do not provide specially for the depreciation of the assets. It was a favourite argument of partizans of this description of municipal trading, that the price of electric light to the public is usually less in this case than the rates charged by companies. A return was got out by the London County Council to support this contention. On the other hand, it was argued that this claim is illusory, inasmuch as, where the figures appear to sustain it, the business is either carried on by the aid of subsidies from the rates, or both ends are made to meet by ignoring depreciation. Hereupon various conflicting opinions as to the right meaning and the sufficiency of depreciation allowances arose and found expression. It can scarcely be said that the controversy came to an end satisfactory to all parties.

It cannot be claimed for electric lighting from central stations that immunity from breakdown has been secured or even brought appreciably nearer. On the contrary, whatever may be the saving of expense in generation realized by the new-fashioned "bulk" schemes, they must be open to the risk unavoidable when many eggs are carried in one basket. One of the most recent of these breakdowns, which occurred in Westminster during the morning of the densest fog of the winter (on the 4th inst.), was particularly disconcerting to the users of the light ordinarily provided by the local Company. Of course, it happened at a most inconvenient time. Everything at the station was going at full speed ahead, in the enjoyment of one of those full day-loads so greatly desiderated by supply companies, when a short-circuit occurred in the armature of a 225-kilowatt machine. It was all over in moment. Before the switchboard attendant could reach the apparatus controlling that particular machine, the whole of the dynamos had pulled up. There was a battery; but the fuses blew at the same instant, and the station lights and all the others in circuit went out. It was half-an-hour before "the entire network was once more alive." The electric light also failed in Bristol one evening last week. A few street-box explosions, and fires due to electric wiring, have likewise occurred during the year to keep on the alert those who have harnessed to the wheels of civilization the artificial analogue of the lightning. For one thing mechanical engineers are greatly indebted to the later electric lighting stations, and that is the experience gained in the use of mechanical boiler-stoking appliances and steam turbines on the largest scale. If the latter form of prime mover is capable of superseding the reciprocating steam-engine, as some believe, the result is largely attributable to the encouragement held out to the makers by the designers of big electricity generating plant, who prize highly the compactness and initial cheapness of the steam turbine.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see page 832.)

LAST week was a short one of only four days on the Stock Exchange; and perhaps it was well that the week was not longer, for it was terribly flat, and things went from bad to worse. A momentary pause in the descent took place now and then, but prices soon resumed their downward course. The cause of this was, of course, the apprehension of war in the Far East, with the risk of the conflagration spreading elsewhere; and even the sanguine believers in a pacific issue began to waver. The tension makes the long nineteen-day account all the more trying. In the Money Market, a good demand kept rates steady at first. But they were disposed to be easier later on; and discount rates were decidedly slacker. Business in the Gas Market was very quiet, sellers holding off as much as possible in such a time of general depression, when an offer of very moderate size was often sufficient to send the price down as if the market was being flooded. Changes in quotation were happily not numerous, for they were almost inevitably in the downward direction. In Gaslight and Coke issues, there was more firmness than in any other. The ordinary was very lightly dealt in; but it kept well up, and on Wednesday it even marked top price once. The secured issues, too, held their own generally, though one parcel of the Company's debenture stock was let go "specially" at an easy figure. A small amount of business was done in South Metropolitan at poor figures; one bargain being marked at 115, and the quotation dropping a point. In Commercials, nothing was done but one transaction in the debenture stock, which, being offered just when things in general were at about their flattest, had to suffer accordingly, and the quotation went down a couple of points. In the Suburban and Provincial group, Crystal Palace had a similar experience, and lost two points also. Business in the Continental Companies was very restricted; but it sufficed to show marked firmness in European. Imperial, however, was weak, and receded three points, changing hands twice at the low figure of 197. In the remoter undertakings, nothing occurred which calls for notice. The Water Companies had a brilliant week; and in the short time at their command, they achieved some astonishing advances, culminating in a 32 per cent. rise in Grand Junction. Kent and Southwark gained 17½, and many others had more moderate advances. The market was, of course, inspirited by the decision of the Arbitration Court thus far delivered, which removed a very sinister impression from the minds of interested parties.

The daily operations were too slight to demand further detail. Movements were: On Monday, Grand Junction Water rose 12½. On Tuesday, Commercial debenture and Imperial fell 2 each, and South Metropolitan 1. In Water, West Middlesex gained 15, Kent 10, ditto new 5, Lambeth 7½ per cent. 5, and Southwark 5; but East London dropped 2. On Wednesday, Chelsea Water rose 5, Southwark 2½, and Grand Junction 2. On Thursday, Crystal Palace fell 2, and Imperial 1. In Water, Kent moved up 7½, Southwark 3, both Lambeths 2½, West Middlesex 2½, and Grand Junction 1.

The Millennium Light in Berlin.—In connection with the particulars in reference to this light given in the "JOURNAL" for the 8th inst. (p. 616), the following remarks made by Dr. Leybold, in the course of a review of the year at the meeting of the Association of Gas and Water Engineers of Lower Saxony, held at Brunswick in October, may be of interest: It is a well-known fact that, while formerly it was impossible for gas to compete with the electric arc light, recent inventions have enabled it to do so with perfect success. This is particularly well demonstrated by the experiments made in Berlin with about 150 lamps for compressed gas. The system adopted is the so-called Millennium light, with burners consuming from 600 to 1200 litres of gas while giving a light of from 700 to 1500 Hefner candles. The system has been installed in the Alexander Platz, Alexanderstrasse, Koenigstrasse, Muchlendamen, Molkenmarkt, &c., partly with single burners of 600 and 1200 litres, and partly with double burners in each lamp, so that the light obtained possesses a power of 3000 Hefner candles. The illumination of these streets may well be said to be more brilliant than practical requirements appear to demand; and its installation seems to be mainly justified by the object-lesson it gives in demonstrating that gas may successfully rival the electric arc light. The comparative tests made by Professor Drehschmidt regarding the degree of light produced by the Millennium system as against the electric arc light of 17-ampere lamps conclusively prove that in the streets where the tests were made, the former is superior to the latter in candle power as well as in the equal distribution of the light. The plant for the illumination is erected at the head offices of the gas-works, Klosterstrasse 68, and consists of two gas-motors and compressed gas apparatus. Each motor, however, would alone be sufficient for the illumination of all the streets where the system is introduced. The extraordinary power of the light in the streets mentioned may well be described as overwhelming; and according to the opinion of an eminent electrician, this system of lighting is the most dangerous rival the electric light has so far had to compete with.

AN INTERESTING INSTALLATION OF SCOTT-SNELL LAMPS.

THE photograph which is reproduced herewith is one which will have more than passing interest. The view is part of Whitehall and Parliament Street; and the lamps which are elevated above others in the neighbourhood are representatives of the new Scott-Snell gas-lamps which have been chosen for the lighting of this important thoroughfare. There is perhaps not a thoroughfare in London that is more coveted by lighting engineers than this particular one—running as it does past the Government Buildings, and being one of the main (in fact, we might almost say, the main) approach to the Houses of Parliament and Westminster Abbey. Therefore, the Scott-Snell Self-Intensifying Gas-Lamp Company, Limited, may be congratulated upon having secured the contract for the lighting of this choice position; and they may depend upon it that gas engineers who have the opportunity will soon, upon this intimation of the completion of the installation, be going to inspect what has been done there. The short intermediate lamps, it should be noted, will be removed in course of time, but that is a piece of work that does not come within the Company's contract.

In the first place, it should be stated that the ground covered by the installation runs from Bridge Street to the Horse Guards; and the measurements are approximately as follows: West side, about 1366 feet; east side, about 1400 feet; and the width of the carriage way varies from 83 to 98 feet. On the west side, seven lamps have been erected at distances varying from 160 to 230 feet apart. On the east side, there are eight lamps, at distances varying from 150 to 232 feet apart. From side to side, the lamps are placed diagonally to each other; and the diagonals vary from 110 to 155 feet in length.

THE SCOTT-SNELL LAMPS IN WHITEHALL AND PARLIAMENT STREET.

Dealing with the features of the lamps themselves. They are of the same character as those in use in Chelsea and elsewhere, except that, in view of a larger unit of light and therefore the combustion of more gas, the cylinder is somewhat lenghtened to provide more radiating surface to counterbalance the increment of the heat. Each lamp is automatically supplying itself with a jet of compressed air, at a pressure of between 30 and 40 inches of water column; and in one or two minor details of arrangement, the lamps differ from any previous ones sent out by the Company. But perhaps, apart from the character of the general lighting by the lamps, a feature of considerable interest will be the height of the columns, which raises the light not less than 20 feet above the pavement. This height is what would obtain in an electric-light installation, and was specified in the original contract. Presumably, this was drawn up so as to admit of tenders for electric lighting, as well as of gas or oil, and has necessitated certain innovations compared with lamps on the level of those common to gas lighting. For instance, the columns have been provided with doors at the base, and chains from the gas-tap above have been brought down to these doors, so that the tap may be operated from the ground level, without the use of a ladder. The air-supply valves which are used in the Scott-Snell system are also placed at the foot of the lantern, instead of on the top, in order to make them readily accessible to the cleaner. The lamps being fitted with climbing irons, it is easy to re-light the bye-pass if accidentally extinguished, or to clean the valves just referred to, without the use of a ladder.

A few words regarding this innovation in the height of street gas-lamps. It is well known that with arc lighting the most effective angle of the rays is about 45°; and therefore the posts are kept comparatively high. But recent practice in America with the enclosed type of arc lamp has, we learn, led to a general reduction in levels, on account of the better value of the horizontal beam of light in that type of lamp. This same advantage occurs with the incandescent mantle; but, as already pointed out, the level of the posts was not left to the choice of the contractors.

From the introduction of the Scott-Snell system, it has been one of the Company's emphasized claims that it gives them the ability of providing high-pressure lighting in any position and over any distance without special mains or disturbance of the surface of the street; and it must be conceded that the installation in Whitehall and Parliament Street (where, though a busy thoroughfare, no inconvenience has been occasioned during installation) might be held up by them as an excellent illustration of this. Another point upon which stress is laid is that the decentralization which the system effects is an advantage which should be remembered, inasmuch as an accident to any one lamp does not in any way affect the others.

A comparison of the old system of lighting and the new will be of interest. The system of lighting displaced consisted of 35 flat-flame lamps, each containing three burners consuming 18·48 cubic feet of gas up to midnight, after which they were reduced to 5 feet per lantern. The total consumption of gas per lighting year of 3940 hours would therefore amount to 1,616,946 cubic feet; and the total illuminating power, it has been computed, would be about 2070 candles before, and 560 candles after midnight. The new system consists of fifteen lamps, each containing two high-pressure burners. The total consumption of gas per lighting year will be 1,654,000 cubic feet; and the total power is calculated out at 14,700 candles.

In order to arrive at some common basis for making a comparison of costs, it may be assumed that both systems are in operation for the same number of hours—say, 3940—and it will then be found that the consumption of gas and the candle power, accepting the foregoing figures as accurate, work out as follows:—Gas consumed per hour: Old system, 646; new system, 420. Total candle power: Old system, 2070; new system, 14,700. Gas consumed per annum: Old system, 2,548,482 cubic feet; new system, 1,654,800 cubic feet. Or a saving of 893,682 cubic feet of gas per annum, and an increase of 12,630-candle power. In other words, these figures, it is seen, represent, by the introduction of the Scott-Snell lamps, a reduction in the cost of gas for the lighting of this area of about £105 per annum in combination with a light of seven times the original volume.

Calculated on the same basis, the respective costs of the two systems for the light obtained may be found. It must, however, be pointed out that, in the case of the old system, the figures given are only for gas consumed; while those for the Scott-Snell lamps are based on the actual cost to the Council for gas and maintenance.

	Total Cost per 1000 Candles per Hour.	Total Cost per Candle Power per Annum.
Old system, for gas only	9·065d. ..	35·703d.
Scott-Snell lamps, for gas and maintenance	1·057d. ..	4·163d.

Of course, these figures, being based on a contract, are not scientific data for exact calculation; but the previous figures treated under the same headings of total cost per 1000-candle power per hour, and total cost per candle power per annum, gas consumption only considered, would come out as follows:—

	Total Cost per 1000 Candles per Hour.	Total Cost per Candle Power per Annum.
Old system, for gas only	9·065d. ..	35·703d
Scott-Snell lamps, for gas only . .	0·829d. ..	3·265d.

These various figures should make municipal authorities ponder over this question of the lighting of their streets; for many thoroughfares are still poorly lighted by flat-flame burners, and in them those responsible might turn to some similar powerful light, and yet save money. When the width of roadway is considered in this case, it is obvious that few exactly similar thoroughfares could be found. But the moral is plain—the narrower the street, the less the unit of light required; and therefore the greater the saving with equal efficiency in the illumination for street traffic. Notwithstanding the great width of both Whitehall and Parliament Street—which nothing but high-power lamps could effectively illuminate—with the new system, the roadway, even to the midway extremes between the lamps, is efficiently lighted; and, be it marked, without any assistance from the surroundings. The huge begrimed buildings afford no helpful reflecting surfaces for the lights; and there is no shop lighting, excepting to a negligible extent on one side at the Parliament Street end, to render aid. Save at the refuges, where the Sugg high-pressure lamps still reign, the Scott-Snell lamps stand for judgment entirely on their own merits. The diffusion of the light is splendid—more especially considering the distances the lamps are apart. It will be a point of interest for observers to note that the two burners in each lantern are situated diagonally, so that both mantles are fully exposed to view through each pane of glass without the interposition of a rib of the lantern. In this installation, the verdict must be that the Company have, within the limits of their contract, done exceedingly well.

One remark in conclusion. The gas lighting community may congratulate themselves on possessing such an effective illustration of the recuperative powers of what our electrical friends have been pleased to so unprophetically name "a dying industry;" and, coming as it does at a time when Marylebone is agonizing in a fit of electrical indigestion, and some towns are eschewing and others are gently dropping the incubus of electrical illumination, it is a useful reference for friends of "economy with efficiency" in municipal matters.

INSIDE AN INFLATED GASHOLDER.

By Wanderer.

It is not often that the opportunity arises for paying a visit to the inside of an inflated gasholder; and it is not often that one would care to commit himself to a holder in that condition. Of course, it all—or rather largely—depends on the one simple circumstance as to whether the inflation is caused by something gaseous or purely atmospherical. One of the holders at the Southall works of the Brentford Gas Company has lately been standing fully extended by air. It is a large single-lift one; being of the unusual depth, for a single-lift holder, of 50 feet, and 110 feet in diameter, with a capacity of about 500,000 cubic feet. So that a single-lift though it be, it is not by any means a small affair. The holder has lately been, in some degree, reconstructed—principally for a purpose which will be stated presently.

However, when Mr. James Husband, the Engineer, happened to mention to two or three of his friends a few days since that he was making a visit of inspection inside this particular holder while it was inflated, and before finally taking it over from the Contractors (Messrs. Samuel Cutler and Sons) who have been doing the reconstructional work, those friends wanted to accompany him. There was something novel, and just a spice of adventure about it for the uninitiated. The terrors of the situation for the inexperienced were duly impressed upon them. An ascent 50 feet up a perpendicular ladder outside the holder, the dropping through a manhole in the roof, and the descent of another ladder into the black depths below, and then its ascent on returning. None of these things were sufficient to arouse fear; and remonstrance did not avail. The mysteries (to Mr. Husband's friends) of the interior of that holder were going to be explored if he would give his assent; and he yielded. Thus it was that on his inspection a few days since he did not go unaccompanied.

The proposal reached the ears of the Manager at the Southall station (Mr. W. Bugby); and he—apparently with a feeling of responsibility for the safety of the visitors—determined to do a part in making the visit as agreeable as possible for the intrepid (while on *terra firma*) laymen, and to assuage for them the perils for untrained nerves attaching to that 50 feet of straight iron ladder securely fastened to the outside framing. And so it came about that, when the little party reached Southall, they found that a wooden cage had been prepared for them, which, by ropes and pulleys fastened to the uppermost girder, was to hoist them to the top of the holder comfortably, though perhaps such a manner of going was somewhat undignified in the presence of the engineers, contractors' representatives (of whom Mr. Ernest Cutler was one), and the contractors' men accustomed to great heights and all kinds of monkeyism on girders, or any other place or member where lodgment can be effected by a human being, at any altitude. But dignity was cast to the winds, and up the visiting party (which included Mrs. Husband and Miss Garwood, her niece) went, being hauled to the top by the willing hands of the workmen. A fine view of the surrounding country was obtained from this point of vantage; and it was seen what splendid prospects the district holds for the Company with so much of their 50 square miles of territory undeveloped, and yet with such conspicuous prosperity in hand.

Over the manhole through which the visitors were to descend into the holder was a small portable hut; and into this hut they entered in pairs, after some of the workmen had descended. One at a time, they were, with little ceremony, quickly assisted through the opening, with the confined air meantime whistling out. The lid had necessarily to be frequently fastened up during the interruptions that were unavoidable. However, eventually the members of the party found themselves on a substantial platform supported on the trussing just under the roof. Probably the two ladies already named were then the first of the fair sex who have found themselves enclosed in an inflated gasholder. The platform was lighted by the candles carried by the workmen; but all was blackness beyond. The visitors, huddled together on the temporary staging, were invited to descend a ladder, some 50 feet long, set as vertical as ladder was ever set by British workingmen. The darkness down below, the sound of moving water, the unearthly noise made by men walking on the top of the holder, and twinkling candles in the distance just showing to the "intrepid" ones the shadowy forms of men moving about—there was something, someone said, weird about it all; and the invitation to descend the vertical ladder was not jumped at by the visitors. The majority stayed where they were; it was the minority and experienced who went below. The refrain of the old school song—

> And we jolly sailors were up unto the top,
> And the land-lubbers lying down below

occurred to one, but it did not apply. The positions were reversed; and it was the land-lubbers who completed their inspection of the mysteries of the inside of that 50 feet deep holder from the safe position of the staging in the roof. It was an experience for them. But the minority descended; while a workman contentedly and unconcernedly sat near the top of the ladder with a guttering candle projecting from his mouth, the drops from which candle fell with unerring directness upon the clothes of the descending minority. The majority admired and envied the nerve of that workman, and subsequently pitied the minority, with, at the same time, a feeling of thankfulness that they had escaped from the one consummated peril of the descent. The inspection over, even those who had remained in the roof did not deem the time they had spent wasted; but as the manhole was again opened in response to a signal, the visiting party got out into daylight again with as much alacrity as the dimensions of the manhole would allow.

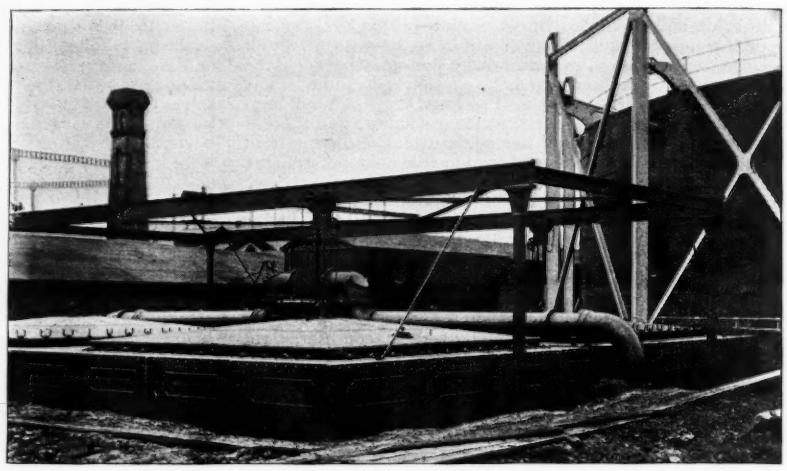
From the top of the gasholder to the ground, by the thoughtfully arranged temporary lift, was but the work of minutes; and it was not till then that it occurred to anyone to inquire why the holder had been to an extent reconstructed. It was gathered from Mr. Husband that the principal part of the work had been occasioned by the increasing demands of the outlying portion of the district, to which the Company are arranging to deliver gas by means of a higher pressure. The holder which had just been visited was selected as being especially suitable for a pressure storage holder; and, as it required repairing in certain particulars (being an old one), it had been provided with heavy sheets in the roof, and with a series of weights placed on the bottom curb, by which means its delivery pressure has been increased from 5·8 inches to 11·25 inches water column; and it can be readily raised above that if required. The structural parts of the holder and the guide-framing have at the same time been put into consistent repair. The gas is delivered, by means of a rotary blower, into this pressure storage holder from the ordinary telescopic holders, as their lifts descend and the pressure thrown by them drops. And so the pressure on the service main is in this way always maintained constant, according to the requirements. The average initial pressure at Southall with this holder will be 9 inches. There are no extraordinary features about the reconstruction work; but the altered holder places the Engineer in a comfortable position in regard to the pressure which he has to give in the extremities of his large district. That was what the little party of his friends (of whom the writer is one) learnt when he consented to allow them to accompany him on his inspection of the work. Though a 50-feet vertical ladder passing through darkness, and ending on (to strangers) some unknown place may have slightly damped their courage, not one of the party regretted the interesting experience Mr. Husband kindly provided.

The death occurred on the 19th inst., at her residence in Champion Park, Denmark Hill, after severe and protracted suffering, of Mrs. Backler, widow of Mr. Henry M'Lauchlan Backler.

In the "Journal" for the 8th inst., reference was made to the final report of the Royal Commission on Arsenical Poisoning, which was issued on the previous Thursday. There have now been issued two further Blue-Books, containing the minutes of evidence given before the Commission, and appendices. The first contains the evidence received in 1901, together with appendices 1-15 and the index, being Part II of the first report of the Commission; the second, the evidence received in 1902-3, together with appendices 16-32 and the index, being Part II. of the final report.

A PATENT SYSTEM OF WORKING PURIFIERS AT WALTON-ON-THAMES.

We give an illustration showing the distinguishing features of a new set of four luteless purifiers, each 20 feet square and 5 feet deep, recently erected at the Walton-on-Thames Gas-Works by Messrs. Edward Cockey and Sons, Limited, of Frome, under licence from the inventors. The patent referred to is No. 12,034, dated September, 1902; and an illustrated abstract of the specification appeared in the issue of the "Journal" for Sept. 9 last year, p. 688.



The object of the patent is to dispense entirely with connected pipes between the centre-valve and the various boxes. This is accomplished by joining up the four in one block, and placing the centre-valve on the top at the point of intersection, so that it projects a quarter-circle over each box—that which usually serves as an outlet-box in purifiers, being in this instance made use of as an inlet in a specially designed manner. The inlet gas enters at the bottom and leaves at the top, as is the case with ordinary purifiers; and it is not found that any short-circuiting of the gas through the portion of the material in the immediate neighbourhood of the valve occurs. But if desired in large purifiers, a wooden shoot can be attached to the inlet-box at the bottom, to convey the gas to the centre or any other part of the box.

There is thus a very considerable saving of space as compared with the usual plan. A set of four 20-feet boxes, with connections, &c., would require a clearance between each of at least 4 feet, to leave space for the centre-valve, and about 2 feet at the sides. This would mean a building not less than 50 feet square. Under the new system, the building need not exceed 40 feet square. The usual connections from the valve to each box would include at least twelve special flange doorway bends, besides a considerable length of pipe, which costs a good sum in the first place, and must be periodically cleaned out. The new system, therefore, not only economizes first cost, but also working expenses. There is no need for trenches or cellars, or for setting the purifiers on the overhead system, in order to leave the connecting pipes free for cleaning or inspection; but as there are no underground connections, the whole can be bedded solid on a simple foundation, and at any level desired or considered convenient for working.

The covers are designed on Green's well-known system, without water lutes; and having no sides, they are much lighter than the old pattern, and therefore admit of simpler lifting and travelling gear. In place of the usual travellers or goliaths, there are two **I** girders supported across the centre line of each pair, on columns, with the necessary cross-bracings and diagonals. On these girders, is fitted a simple form of travelling blocks and falls—the arrangement being clearly shown in the photograph. Any other suitable means may be employed according to the circumstances existing, and having regard to the size and weight of the covers used. The frames for receiving the covers on the top of each box are about 15 feet square, and are supported from the bottom by cast-iron uprights in each box, which are also arranged to form part of the carrier system for the grids. Provision can be made for any number of grids. The top plates are strengthened on the underside, and taking a bearing on the cast-iron uprights above mentioned, they form a safe working floor.

The whole, as fitted complete under the patent arrangement, has effected a saving of from 10 to 15 per cent. on the cost as against the usual centre or other valves and connections.

A HELP FOR INVENTORS AND PATENTEES.

It is not often that we are able to so heartily and unreservedly recommend a law-book to those who are not lawyers, as it is our pleasure to do in the case of Mr. James Roberts's book on British patents for inventions.* This is really and truly the very best guide that has yet appeared for inventors and would-be patentees, not into the intricacies of the patent law, as professional advisers and advocates know them—for that would be impossible for any book—but to so much of the open secret of this branch of law as, let us say, a good manual of field botany can teach as regards the identification of wild flowers. This is the kind of assistance the ordinary man needs. According to the hoary old joke of the British Constitution, all men are supposed to know the law. In point of fact, the Courts exist to demonstrate the contrary. But this by the way. What the ordinary citizen really does know in regard to the law is, that the moment he steps aside from or beyond the familiar path of his daily affairs, he is in danger of falling into a quagmire of litigation. If he happens also to be afflicted with a mechanical twist, the British citizen is very likely to drop into invention, as Silas Wegg did into poetry; and then his troubles are apt to begin. For the inventor is naught if he does not proceed to patenting his invention. This seems a simple development; but the would-be patentee envisages another world from that in which he dwelt as a private person with no such aspirations. The first thing he needs is knowledge of more law than he ever wanted before. Of course, if he places himself at the outset in the hands of a trustworthy patent agent, he will be kept from going wrong. But just as the ordinary person, although he may have a medical attendant, wishes to know enough of the laws of healthy living and the nature of his own constitution to keep well, so the patentee naturally desires to learn at least the elements of the legal system to which he owes this specific status of his. It is not too much to say that this knowledge cannot be obtained from the gratuitous literature distributed by a certain stamp of patent agents. Those who would acquire it must apply to a competent and impartial source of the necessary information; and in this capacity it is our pleasure to recommend the present work as the very thing that is required.

There are many ways of planning a law-book. Where the law is contained in a particular statute, or group of statutes, the author may either begin with the text of the Acts and supply a running commentary as he goes on, which is the method usually practised, or he may start with an introduction of his own, designed to tell the reader all about it, finishing up with the Acts and cases. In the hands of a capable lawyer, the latter, which is that of Mr. Roberts, is the preferable method, provided that it is done with sufficient thoroughness. The model to be followed is the charge of a judge to a jury. When one compares the elementary character and the lucid statement of legal principles of the best charges with the style of many law-books, one is led to wonder why the writing of such books is not reserved for judges. Possibly, if it were, there might be fewer lawsuits; and the interests of the Bar might suffer. Mr. Roberts has had the happy inspiration of telling the would-be patentee, and incidentally the inventor's possible patrons, precisely what it is necessary for them to know about the legal nature and the proper drafting of valid patents. He does not throw the Patents Acts at his readers' heads, leaving them to pick out the parts that affect them; he explains as clearly as possible the difference between presumptive validity and obvious invalidity in patents. This is the one thing that a book can do; and the book in question does it remarkably well. No man, however skilful, can be sure that a patent of his own or another is valid until it has withstood the trial of a contested action; but the fact, recognized by the Patent Office, that every other patent issued is invalid, is another consideration altogether. It is certainly within the power of every patentee, with proper instruction, to place his patent within the, at present, small minority of those which are presumptively valid, and challenge litigation to prove the contrary. This is certainly consolatory.

Like many other critics of the British patent system, however, Mr. Roberts appears to encourage the erroneous idea that British patentees are exceptionally ill treated. He lays stress upon the calculation that "sums amounting to £23,120 per annum are paid for patents which give no legal protection to the patentees." He thinks that "this state of affairs brings discredit upon all British patents, and diminishes the market value even of those which are valid." We venture to submit that the price named is cheap for the absolute liberty enjoyed by the British patentee—to say

* "The Grant and Validity of British Patents for Inventions." By James Roberts, M.A., LL.B., &c. With many diagrams. London: John Murray.

nothing of the circumstance of the Patent Office being consequently his friend and adviser, instead of his master and oppressor, as it is everywhere else. British patents are as good as any foreign ones, when properly drafted and taken out with forethought; and no others are in any better case. It has always been a feature of the "JOURNAL" to defend the British Patent system from ignorant and partial vilification; and though we would not accuse Mr. Roberts of inclining to disparage this truly admirable British institution, still his rather depreciatory reference to a particular aspect of the system is not to be passed over without protest. As a matter of fact, there is not much amiss with our system; and almost the only remediable defect—that of allowing patents to issue tacitly for inventions notoriously old and anticipated—will shortly be repaired. This improvement is expected to come into operation early in 1905. After all is said, however, the tax which ignorance and heedlessness pay to the British Exchequer in the form of wasted Patent Office fees, is the merest trifle, not worthy of one moment's consideration, beside the amount of money—35 millions a year—thrown away in England in worthless company speculation, or paid to small effect for "patent" medicines.

Still, of course, nobody wishes to squander money in this way, nor to incur risk of being disappointed by a bad patent; and Mr. Roberts can help to prevent this loss and vexation. He takes the inventors' point of view throughout; entering into the questions of what constitutes invention, and how it can be protected by a patent. The former is a tremendous problem, and though the rules by which the Courts test invention are fairly well ascertained and defined, there is immense difficulty in applying them to cases. True novelty, of any element in a mechanism or a process, is extremely rare—so rare, indeed, that it may generally be left out of consideration. In the enormous majority of cases, what is asserted to be an invention is for the application of old means to novel purposes, or for the combination of known parts to obtain new and useful results. Often the very copying of an invention serves to point out its merit, which it might otherwise have been difficult to distinguish. Having made up his mind, on looking into the matter, that he has an invention to patent, the inventor's next care is to give it its proper title. Mr. Roberts discusses the nature of the title in regard to the old and new procedure. It is a most important part of the documents. Although not now held to be a statement of the inventor's claims, it is still required to cover them; for no extension of scope will be allowed beyond the title. The provisional specification is capable of being described as an extension of the title. It must describe the nature of the invention, but need not contain anything else. Inasmuch as patents are now sealed as of the date of the application, which must be accompanied by the provisional specification, the function of this document is to inform the Government, as representing the public, as to what was in the inventor's mind at this period. For this reason, the provisional specification should be candid, but may well be as wide as it can be drawn without losing its sense; because while the subsequent complete specification must be more precise, it cannot be wider. The inventor may say as much as he pleases about his invention in his provisional specification, but it is not expedient to do so. He is not required to give the objects of his invention, nor the mode of carrying it out. For example, an invention for "a gas-cock to pass a determined quantity of gas during a certain period of time," would be covered by this general description of its nature.

The complete specification must particularly describe and ascertain the nature of the invention, and in what manner it is to be performed. It must begin with the title, and end with the statement of claim. This business is exhaustively dealt with by Mr. Roberts; but one point he does not make, though it is of cardinal importance, and that is the obligation which is incumbent upon the patentee to use words in their proper meaning. Really, when one observes the questionable language that passes current for technicality, it ceases to be surprising that so many patents are invalid for reasons other than the recognized legal grounds. This prevalence of the employment in ordinary speech and writing of words in a wrong sense, is one of the strongest reasons why intending patentees should place themselves at the earliest possible moment in the hands of competent professional advisers of good standing. It is, unfortunately, almost as difficult for an imperfectly educated person, whose sense of the meaning of words has been degraded by slang and bad journalism, to know good language when used by others, as it is to use it himself. We have frequently noticed, in the pamphlet of an advertising patent agent, diction which should be quite sufficient to deter anyone from trusting his construction of a document. The ordinary man who thinks of taking out a patent should profoundly distrust his own ability to express his meaning in set terms, good enough to bear the scrutiny of a judge constrained to interpret words strictly. This is where the assistance of a skilled adviser should come in. Many a would-be patentee may think, and quite justly, that he knows as much about the nature and novelty of his invention as any consultant; but this is not everything. The practical man, one who is not learned in patent law cases, may know what he wants to do; but he may be incapable of describing it in proper terms, or of claiming it clearly and unmistakably. Patent specifications are full of pitfalls, into which even the wariest not infrequently tumble. Practical men are especially apt to confuse the nature of an invention with its object; which the Courts are particularly careful to separate. Their distinctions would often strike the practical man as a mere play upon words, and he would fail to appreciate their true significance. Occasionally, indeed, he would find himself credited in this way with something which he did not look for; but usually patents are invalidated for want of agreement between what is held to be the essence of the invention and the language of the claim. The well-known patent of Frank W. Clark for gas-lamps—dated 1881, and consequently expired—was an example of the favourable construction of a patent specification as to the meaning of which there were at the time many differences of opinion. Mr. Roberts's array of leading cases is very instructive, especially from his method of pointing out the precise merit of the precedent, and noting its subsequent applications. In this way the reader gets an unexampled insight into the legal meaning of such principles as the sufficiency of the degree of ingenuity that must go to constitute an invention, as distinguished from a "mere adaptation;" and so forth. The student of cases must be prepared to find himself in strange company, or he might be startled to discover a patent for bustles shedding light on one for the guiding of gasholders. A good index adds materially to the value of this book, which should be in the hands of all those who are interested in patents and the patenting of inventions.

PERSONAL.

On Wednesday, the 23rd inst., Mr. FRANK A. WINSTANLEY, the Engineer and Manager of the Rotherham Gas-Works, was the recipient of a handsome marble timepiece, the gift of the workmen, on the occasion of his recent marriage. The presentation was made by Mr. Thomas Sleight, the oldest workman, who referred to the great respect they had for their Engineer, and expressed the wish that he might enjoy a long and useful career. A few days ago, a beautiful cake-dish was also presented to Mr. Winstanley by the Secretary and the office staff of the works.

OBITUARY.

The death took place at Altrincham, last Wednesday, of Mr. HENRY BARRETT, Secretary and Manager to the North Cheshire Water Company. Deceased, who was 63 years of age, had held his appointment under the Company for upwards of thirty years.

The Ormskirk Urban District Council have sustained a loss by the death of Mr. R. WALKER, the Chairman of the Water Committee. At last week's meeting, the Chairman of the Council (Mr. C. F. Ellis) referred to the services which deceased had rendered to the town, and said he had been the means of putting the water undertaking on a firm and satisfactory basis.

The death occurred on the 18th inst., in his 86th year, of Mr. ROBERT ETHERIDGE, a well-known geologist. Deceased was a recognized authority on questions of water supply, and made the Thames watershed a special study; but his name has of late years been more closely associated with the boring for coal at Dover. In 1897, he read before the Engineering Conference a paper on "The Kent Coalfield," in which he affirmed his belief in the existence of an extensive and valuable coalfield in the South-East of England or near Dover, and also in the relation of the coalfields of the South-West of England (Bristol and Somerset) and those of the North of France and Belgium, as indicated in the similarity of mass and structure, uniformity of subjection to like physical causes, and identity of relation to the underlying older and the overlying newer formations. He was made a Fellow of the Royal Society in 1871, a Vice-President in 1874-5, and he served on the Council in 1884-5. He was awarded the Murchison medal of the Geological Society in 1880, became President of the Society the year following, and in 1896 was presented with the first Bolitho gold medal of the Royal Geological Society of Cornwall, in recognition of distinguished services to geology, more especially in the Western counties.

The Metric System.—A paper on this subject was read by Mr. Alexander Siemens, at a recent meeting of the Royal Statistical Society. The author expressed his conviction that, though scientific men had for some time previously been discussing the subject in a general way, there is little doubt that the present metrical system is the result of the agitation of James Watt, who took up the subject in the year 1783. The history of the question in this country was traced from the year 1824, when Parliament was first approached on the subject. In France, the metric system was not really legal, to the exclusion of every other, until January 1, 1840—a little more than sixty years ago. In Germany, where the metric system has been in use not much more than half as long as it has been in France, though a few old names of weights and measures are in use, they really denote metrical measures, and may be treated as only local expressions. The author concluded by expressing the opinion that if we were to adopt the system, our own dependencies and other nations would follow our lead, and that thus international unity of weights and measures would at once become an accomplished fact.

TECHNICAL RECORD.

A NEW RESERVOIR FOR THE HOYLAKE AND WEST KIRBY GAS AND WATER COMPANY.

By Alfred J. Jenkins, Assoc. M.Inst.C.E., (now) Water-Works Engineer of Jersey.

[Extracted from a Paper read at the Recent Meeting of the British Association of Water-Works Engineers.]

The first part of the paper was historical—giving the main events in the development of the water-works of the Hoylake and West Kirby Gas and Water Company; but, as Dr. Smith mentioned them briefly in the discussion, they can be omitted here. The subject of the paper was the new reservoir; and in regard to it, the author said—

The first service reservoir, having a capacity of 585,000 gallons, has up to the present time sufficed for the Company's requirements; but the recent and prospective growth of the district made it desirable that increased storage should be provided. The Company therefore obtained power to construct an additional reservoir; and the author was requested to prepare the necessary working drawings.

At that time, the greater part of the excavation was done, and had been carried to a greater depth than the author would have advised. As it was important that the top water-level should be the same as that of the No. 1 reservoir, the new reservoir, when full, has a depth of water of 23½ feet. The work is almost entirely below the original ground-level, and in substantial but porous rock; so that the chief consideration in designing the walls was that they should carry the roof, and at the same time be capable of holding water under a considerable hydrostatic pressure. There being no reason to anticipate inward thrust, the author considered he could not do better than introduce Callender's bitumen sheeting with thin inside and outside protecting skins of brickwork and concrete respectively. The trimming of the sides of the excavation had not been an easy matter, because the sandstone runs in thin beds of widely different degrees of hardness, and considerably cross-jointed. The sides had, therefore, been left very irregular; and to bring them to an even face, they were lined with concrete. Callender's patent bonding ties were then fixed (one to each square yard); and after each wall was completed to its full height, bitumen sheeting was hung from top to bottom—the bonding ties being pressed through, and the holes so made carefully closed up. The sheets of bitumen were jointed together by means of hot ironing. As soon as possible after the fixing of the sheeting, the sides were faced with 9 inches of blue brickwork in cement mortar. Pilasters of substantial dimensions were introduced as supports to the 9-inch skin, and to take the weights imposed by the joists carrying the roof.

The adoption of an orthodox type of roof of brick arches, supported by brick columns, would not only have involved a prohibitive cost, but would have necessitated columns or piers of such dimensions that the effective capacity of the reservoir would have been seriously reduced. The author determined, therefore, to design a light roof of concrete strengthened with expanded steel, supported by steel joists and arched channel ribs, resting upon steel stanchions. The contract for this portion of the work was placed with the New Expanded Metal Company, who guaranteed the strength of the roof.

The construction of the walls and floor need not be gone into at great length. The concrete was mixed in the proportion of 6 to 1; the best of the stone obtained in excavation, with shore sand from the Dee estuary, and sand obtained by crushing the local stone being used as aggregate. Care had to be taken that soft stone, which was found in layers of varying thickness among the harder beds, was not used for concrete, as it was of a very doubtful character. Moreover, only the very best of the stone was used for those portions of the work subject to heavy stresses. The sides of the excavation required no support except in the case of the west wall, where the strata were undercut, owing to the sharp dip westward, and frequent cross joints. At this point, the base of the wall had to be thickened to 6 feet. The minimum thickness of the floor is 12 inches, consisting of 8 inches of concrete (6 to 1), carefully prepared to form a level bed for the bitumen sheeting; 3 inches of concrete laid over the sheeting; and the inner face rendered with 1 inch of cement mortar (1½ to 1), trowelled to a perfectly smooth surface. The bases for the columns are 3 ft. 6 in. square, and are of 6 to 1 concrete. These bases are of varying height to allow of the stanchions being of uniform length, and yet permit the roof to be sloped from the middle in each direction.

The stanchions, girders, and arched channel ribs are of British steel; and after being painted are all completely encased in concrete and cement rendering. The method of enclosing the stanchions was to surround them, after erection, with expanded metal netting, and to fill in the spaces between the flanges with fine concrete. The whole of the stanchion was then rendered with cement plaster, for which the netting afforded an excellent key. This rendering was put on in two coats, and gave the finished stanchions a very neat appearance. In the cases of the girders and ribs, the lower flanges were covered with netting, and the wood centreing for the roof so arranged that the remainder of the girder or rib would be completely encased in concrete. After the removal of the centreing, the exposed netting was rendered.

The roof itself consists of one continuous slab of concrete, 5 inches thick, in the underside of which are built sheets of expanded steel of 3-inch mesh, of which the strands have a section of $\frac{5}{16}$ in. by $\frac{1}{8}$ in. The roof is divided up into bays, which measure 16 ft. 6 in. by 7 ft 6 in. from centre to centre of supports. The clear span is slightly under 7 feet; and the slab is calculated to support an evenly distributed load of 3 cwt. per foot super, with a factor of safety of 4. It will be understood that with such a thin slab of concrete only the very best materials could be allowed. In this instance one part of cement was used to four of aggregate. The centreing was first covered with oiled paper; and the expanded metal laid upon this, with the necessary laps. The concrete was well trodden and spaded down, with the result that the expanded steel was forced slightly up and remained embedded in the bottom ½-inch of the slab, where it was effectually sealed, and protected from oxidation.

A specimen slab of concrete was tested to destruction when about three months old, and proved that the anticipated strength was fully attained. With the concrete properly gauged, and the correct section of expanded metal as tension bond, the formula given below has been proved by many experiments to give the safe working load: If s = span in feet; t = thickness of slab in inches; w = safe distributed working load with a factor of safety of 4: $w = 6\frac{t^2}{s^2}$.

The following rule will give the section of expanded steel required: "The sectional area of the strands should equal $\frac{1}{200}$th the sectional area of the concrete slab." It must, indeed, be self-evident that the introduction of steel in concrete to take up the tensile stresses, and thereby supply the one quality in which concrete is defective, must result in considerable economy, especially where the work has to be supported at an appreciable height. Instead of using rolled joists throughout, three-fourths of the secondary beams are of concrete built upon cambered steel "channels;" whereas, in the case of the slab, steel is, as a matter of economy, brought to the assistance of the concrete, so, in the beams, concrete is brought to the assistance of the steel-work in that portion of the beam which is in compression. The concrete in these ribs was gauged 3 to 1. The "channels" had to be bent to the correct curve, having not less than 1 in. of rise to each foot of span; and the ends were carefully cut to fit the girders upon which they rested. It was also necessary that, before any weight was put upon them, they should be well strutted from below, and that the strutting should not be removed until the concrete was thoroughly set. Upon the completion of the concrete, the roof was covered with Callender's bitumen and 18 inches of earth. The outlet-pipe from the reservoir is 18 inches in diameter, and upon it is fixed a Venturi meter, with a throat ratio of 1 to 12, which will record a minimum flow of 9000 gallons per hour, and a maximum of 130,000 gallons per hour. These figures were adopted in order to provide for a greatly increased consumption in the near future, and also to permit of the registration of small flows. The capacity of the reservoir is 2,530,000 gallons; and the net cost has been £8950, exclusive of the mains beyond the valve-chamber, the Venturi meter and house, and the roadway and boundary wall, which have cost £1150.

Discussion.

Dr. J. Kellett Smith (the Chairman of the Hoylake and West Kirby Gas and Water Company), being invited to speak, said when the Company started in 1877 they built a small reservoir holding 600,000 gallons. They then had an engine which used to draw from 18,000 to 20,000 gallons an hour; and at that time the filling of the reservoir twice a week was quite sufficient to serve the whole district. From that little engine, they had got to one which was capable of pumping 60,000 gallons an hour, besides one that was made by a firm in Nottingham many years ago, and had given them a great deal of trouble. However, the latter was capable of pumping 40,000 gallons an hour. They had two wells situated at Grange Hill. The first was taken down to a level of 240 feet; but, after a few years, they found more water was required than they then possessed. At his instance, the late Mr. Thomas Hawksley was consulted; and he gave it as his opinion that, if they went lower, they would get brackish water. An engineering friend of his (Dr. Smith's) was of a contrary opinion; and so the well was taken down another 42 feet. Brackish water was not met with. Then they sunk a borehole nearly 200 feet. Even then they did not get brackish water, but a very much augmented supply of the best water was procured. The Company then sunk a second well; and made a connection between the two. In this well, they had lately put down a boring, commencing with 26 inches, and continuing, after a certain depth, with 18 inches. Altogether, they had gone down nearly 800 feet; but they had no brackish water there. They had now a very plentiful supply of good water. As to the reservoir, the construction of it was started by the late Mr. C. H. Beloe, M.Inst.C.E. They gradually excavated for it in what was a rocky formation. Unfortunately, however, Mr. Beloe died some two years ago. The result was Mr. Jenkins was employed to complete the work, and right well he had done it. It was an excellent piece of construction, and was perfectly tight. Remarks had been made in the

previous discussion regarding covered and open reservoirs. The first reservoir his Company built used to hold a great deal more water than now, for the reason that it was not covered in. Within six months of their commencing to serve the district with water, they had the reservoir full of bacteria and vegetable and animal growths. The water became very disagreeable; and they were compelled to cover the reservoir. The roof was carried on brick pillars; and these lessened the capacity.

Mr. J. DEWHIRST (Chelmsford) inquired whether any member had at any time constructed a reservoir with steel work introduced in any shape or form, and had the plans approved by the Local Government Board when applying for a loan. About four years ago, he got out a design for a small reservoir; and he introduced some steel girders for supporting the roof—filling in with concrete, and so somewhat reducing the cost of the reservoir. Unfortunately for him, he had the plans returned. The Local Government Board insisted on brick or concrete arches, and would not allow the steel girders at all, even if covered over. He might be wrong, but he ventured to assert that the time would come when the Local Government Board would allow them to use steel in the construction of reservoirs. He should like to know whether £8950 for the reservoir described included the cost of excavation. It seemed rather a small sum.

Mr. P. H. PALMER (Hastings) said he thought he could give a little information with regard to the Local Government Board's ideas of armoured concrete. Three or four years ago, he was wanting to construct an armoured concrete aërating chamber. He was entirely satisfied that he had got a large margin of safety. His plans were considered by the Local Government Board; and he had several interviews with them on the subject. He thought he had persuaded the then Chief Engineer of the Board that the thing was right—in fact, he admitted that it was right. But the Board had had no experience of armoured concrete work; and therefore they did not see their way to grant a loan for such work. The result was he had to build that aërating chamber with brickwork; and so it had cost about three times more than if constructed with armoured concrete.

Mr. S. C. CHAPMAN (Torquay), also referring to the question of using steel in concrete, said that a couple of months ago he had a drawing returned to him from the Local Government Board, in which he had a steel joist embedded in concrete in a roof of a covered reservoir under similar conditions to those Mr. Dewhirst had mentioned. As late as the previous day, he was attending an inquiry by the Local Government Board, where it was proposed to erect a reservoir with steel and concrete. He was told by the Inspector that the Board did not favour such construction. If they granted a loan at all, it would be for some period that would hardly make it worth their while to put up such a structure. Loans for structures of the kind had been for short periods. He believed instances of this were to be found at Bournemouth and Bury.

Mr. T. EASTON DEVONSHIRE (London) said that he had had no experience of the Local Government Board; but in the case of a reservoir constructed in Belgium, they built it entirely of steel girders and concrete. The roof was a good deal lighter than the calculations in this paper, and yet it was an exceedingly strong one. He thought it was a most deplorable thing that in this country there should be this difficulty in benefiting by experience which, in the use of steel and concrete, was some twenty years old on the Continent. If the Association could do anything to break through the red-tape of the Local Government Board in connection with the subject, they would confer a benefit on engineers in this country, and on water engineers in particular. Regarding the reservoir to which he had been referring, it was at the Waelham pumping-station of the Antwerp Water-Works Company. They were going to construct another reservoir of larger capacity, and probably it would be built on the same lines. This construction was cheaper and much safer than the old-fashioned form.

Dr. SMITH remarked that, of course, being a Water Company, they did not require a loan, and so had nothing to do with the Local Government Board.

Mr. PERCY GRIFFITH said they all knew by experience that the authorities at the Local Government Board were very careful. Of course, their work being the protection of local authorities from loss and improper expenditure, no doubt care on their part was very proper. He thought it was obvious that the inspectors of the Board took note of discussions such as they had had that day, where practical men had spoken from practical experience, and had given views which were somewhat different from those of the inspectors at the present time. He was sure the inspectors individually would be only too ready to accept the guidance of practical men, who could bring practical results before them; but how far they might influence the superior body, or how quickly they might get its decisions reversed, of course could not be said. But such practical discussions must ultimately be of value both to the Local Government Board and to the water-engineering profession. Referring to the design of reservoir adopted in the case described by the author, he said his own practice was rather to pin his faith upon one water-tight medium, and to support that adequately. Then he was not particularly anxious about the rest of the wall being of such a high-class nature in respect of its being water-tight. He believed this had a good deal of effect on the cost of the work. One was naturally struck by the variety of practice, which was interesting; but he thought his suggestion was a practical one, and quite safe to be followed under normal conditions.

Mr. WILLIAM MATTHEWS (Southampton) said the opposition of the Local Government Board had become a crying evil; and it extended much farther than perhaps some people had the faintest idea. The Board had laid down certain lines; and their argument was, "We have had no experience in this particular thing." If they had not had the experience, then it was time they began to get it by seeing what had been done. Mr. Devonshire had given a most striking example in the case of a large Company who had to earn their dividends, and who could not afford in any way to have breakdowns. If this form of construction was good enough for them, surely it was good enough for the Local Government Board and the local authorities in this country. They as engineers did not want to borrow money upon flimsy structures; but what they did want was that any scheme that was laid before the Board, which was reasonable and of proved economy, should be accepted, and not be submitted to the whims of the Board. He had been to the Local Government Board, and asked "Who is the Board?" and he had never heard yet. (Laughter.) Their Chief Engineer would say: "Yes, I am satisfied; but there is the Board." Who were the Board? The Inspectors, of course, were themselves the Board. It was a second line of defence that they wanted; if the first was broken down, they sheltered themselves behind "the Board." Not only did they object to steel construction, but they were positively refusing to grant loans for circular reservoirs. In the majority of circumstances, they could construct for a given capacity a circular reservoir considerably cheaper than a rectangular one. This was pointed out to the Board; and they professed to know nothing about circular reservoirs. Why did they not want to know anything about them? Simply because they would not take the trouble to find out. He had not heard of one circular reservoir failing. The reason the Board knew nothing about them officially was this, that these reservoirs had been constructed, under definite Acts of Parliament, where it had not been necessary to go to the Board for their sanction. Most of the schemes which were carried out under the direct sanction of Parliament involved an expenditure of much larger sums of money and of works of greater importance, generally speaking, than the works carried out under the sanction of the Local Government Board. If the system of construction was good enough for these important works, involving, if failure took place, the sacrifice of such large sums of money, surely it was good enough for others of less importance. It was the ignorance of the Board—their own admitted official ignorance; and it was really high time it was put down.

Mr. PHELPS (Shepton Mallet) said he could hardly sit there, and allow anyone to go away with a wrong impression. He had carried out a circular reservoir with a roof with iron girders in it; and it was sanctioned by the Local Government Board. It was finished about twelve months ago. He also attended an inquiry a short time since where the question of armoured concrete was brought up; and he did not find the inspector object to it. He knew, in fact, that the roof was going to be put up, and in armoured concrete, by a loan sanctioned by the Local Government Board. There was considerable elasticity among inspectors of the Local Government Board. They were not any way bound down by rules, and occasionally they did find them giving way. Very often they could get the Board to do things by hammering away, although at first they might be disinclined to do it. The circular reservoir, he added, had wrought-iron joists, with cast-iron skewbacks between. These were not covered; but were absolutely exposed underneath. He should, however, cover them another time. The reservoir contained 100,000 gallons; and the loan was for the usual thirty years.

Mr. PALMER said he might also say that, four or five years ago, he constructed two circular reservoirs 150 feet in diameter. Each held 1½ million gallons. The plans were passed, and the loan granted, by the Local Government Board.

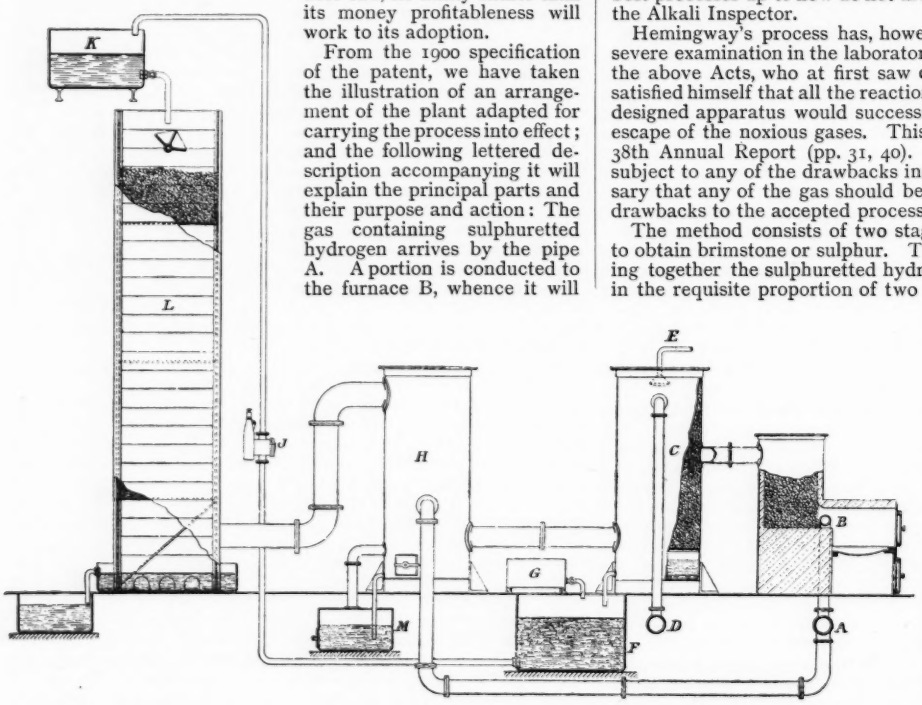
Gas Lime for Manuring.—In some notes on "Practical Agriculture," contributed to the "Reading Mercury" by Mr. Primrose M'Connell, B.Sc., M.R.A.S.E., &c., he says he has gas-limed the greater part of his farm in recent years—having used probably 1000 tons of the material—and has seen it so completely alter the texture of his clay soil that the difference could be felt by simply walking over the ground. The effect on a crop of corn is described as like that produced by nitrate of soda; while the weight of mangolds per acre from a spot where lime had lain has been twice that of the rest of the field.

Gas Supply in Paris Suburbs.—In the "JOURNAL" for the 1st inst. (p. 524), reference was made to the formation of a Company to undertake the supply of gas in the various suburban districts of Paris at the close of the existing Company's concession. The project has not only received considerable support from the local authorities, but, according to "Le Gaz," a contract has actually been entered into between the Council of St. Denis and MM. Rouland Chamon, the projectors of the scheme, and has received the sanction of the Prefect of the Seine. Under the existing arrangement, the Paris Gas Company have the right to supply gas in St. Denis till Dec. 31, 1908; but their concession will be cancelled two years hence, and be replaced by one entered into with the new concessionnaires for a period of 30 years.

REMOVAL OF SULPHURETTED HYDROGEN FROM FOUL GAS EVOLVED IN THE MANUFACTURE OF SULPHATE OF AMMONIA, GAS LIQUORS, &c.

In the "JOURNAL" for April 17, 1900, there appeared an illustrated abstract of a patent of an invention by Mr. H. W. Hemingway, which, briefly stated, related to "the treatment of sulphuretted hydrogen, or gases containing sulphuretted hydrogen, with a view to the elimination and recovery of the sulphur, and incidentally to the manufacture of sulphite of iron, sulphate of ammonia, and other useful products." The invention is now to be exploited by Mr. Robert Booth, who, formerly an Engineer with the old Western Gas Company, has returned into the industry with this process. He has acquired an interest in it, and now holds the right to grant licences for its use. In order, however, to first satisfy himself that the claims of the patent were technically correct, and that the process would commend itself to manufacturers, he caused it to be investigated by Mr. R. J. Friswell, F.I.C.; and it will be seen that he declares the invention to possess valuable merits. No one after reading the report can do other than recognize that the process has a particularly commending feature in the small amount of plant necessary. In connection with the employment of the process, the patentee himself places no emphasis on possible profits accruing, and, indeed, he wishes any views of this kind to be deprecated. But Mr. Booth cannot conceive why a profit should not result. However, the principal object is to prevent nuisance and annoyance. If it accomplishes this desirable end, its utility rather than its money profitableness will work to its adoption.

From the 1900 specification of the patent, we have taken the illustration of an arrangement of the plant adapted for carrying the process into effect; and the following lettered description accompanying it will explain the principal parts and their purpose and action: The gas containing sulphuretted hydrogen arrives by the pipe A. A portion is conducted to the furnace B, whence it will



escape, in the form of sulphurous acid, to the tower or scrubber C; while ammonia or ammoniacal gas, which arrives by the pipe D, is led to the upper portion of the tower. The coke or like porous material, with which the tower is charged, is traversed by a stream of water, which enters by the pipe E; the sulphite of ammonia being thus washed down as it is formed, and flows to the tank F. The surplus sulphurous acid is led to another tower H, the function of which will be referred to later. The tank G contains a solution of sulphate of iron, a regulated supply of which is delivered to the tank. On the sulphate of iron mingling with the sulphite of ammonia, reactions take place which result in the production of a mixture of sulphite of iron and sulphate of ammonia; and this mixture passes to the pump J, and thence to the tank K, whence it is delivered to a third tower L. This tower is furnished with coke or like material, through which the liquid mixture passes; the sulphuretted hydrogen, admitted at the lower part of the tower, passing in the opposite direction. There is a device of the "bascule type" for distributing the mixture of sulphite and sulphate over the porous material carried by the perforated trays. In the tower, sulphide of iron and free sulphur are deposited as solids, while a solution of sulphate of ammonia overflows. Returning now to the tower H, the sulphuretted hydrogen, as it enters, combines with the sulphurous acid, with the result that water and thionic acids are formed, and free sulphur deposited; while the water and acid escape to the tank M, which is charged with scrap iron. The thionic acids are here decomposed; sulphide of iron being formed, while sulphuretted hydrogen is liberated. The latter escapes, and returns to the tower H.

These remarks and explanations will suffice for the introduction of readers to Mr. Friswell's report, which further elucidates the system, and gives expression to his views as to its advantages. The report is dated Dec. 4, and is as follows.

The object of the patent is the removal of sulphuretted hydrogen from the foul gases evolved in the manufacture of sulphate of ammonia from gas liquor. Incidentally, it affords a means of stopping the escape of sulphurous acid as well. This is a matter of much importance to the gas manager, as well as to the public at large, since the escape of these gases is forbidden by the Alkali Acts of 1881-1889, and as yet no process equally satisfactory to H.M. Inspectors under the Acts and to the gas manager has been devised.

The examination of the process which has been carried out in my laboratory for many weeks past, leads me to believe that this object is attained by the process described below. The difficulties inherent in all other processes for the attainment of this object, the accomplishment of which is now compulsory, are very fully detailed in many previous reports, where, to obtain even moderately successful methods, it is shown that these methods are such as to involve the burning of the foul gases—a process of the greatest difficulty, as they are accompanied by very large quantities of steam and carbonic acid gas. Although methods have been devised for condensing the steam, the other gases are not removable by any cheap and convenient method; and the best processes up to now do not always meet with the approval of the Alkali Inspector.

Hemingway's process has, however, been subjected to a very severe examination in the laboratory of the Chief Inspector under the above Acts, who at first saw difficulties in the method, but satisfied himself that all the reactions were valid, and in a properly designed apparatus would successfully and without loss stop the escape of the noxious gases. This research will be found in the 38th Annual Report (pp. 31, 40). Hemingway's process is not subject to any of the drawbacks indicated above; it is not necessary that any of the gas should be burned. One of the greatest drawbacks to the accepted processes is thus at once removed.

The method consists of two stages. The object of the first is to obtain brimstone or sulphur. This object is attained by bringing together the sulphuretted hydrogen and sulphurous acid gas, in the requisite proportion of two volumes of the former to one volume of the latter. Sulphur or brimstone and water are thus formed; the latter runs to waste, and the former is from time to time collected. So far, there is nothing new. This process has been used, but always failed because of the difficulty of dealing with the waste gases leaving the reaction chamber.

Every 64 lbs. of sulphurous acid gas sent into the plant, or (what amounts to the same thing) every 32 lbs. of sulphur burned, produces 96 lbs. of sulphur in the sulphur chamber of the plant. It follows that, after buying some sulphur to start operations with, the plant not only becomes self-supporting, but produces a constant supply of sulphur derived from the sulphuretted hydrogen entering. A small quantity of thio-sulphuric acid which is produced with the sulphur, flows away with the water; and the sulphur therein is recovered by means of a small tank, containing scrap iron, into which this liquid passes, so that, as the Inspector who investigated the process found, nothing is lost.

After the gases have met in the sulphur chamber, and thus been reduced to the innoxious condition of water and sulphur, there should in theory be nothing left that can cause trouble. This is, however, obviously not possible in practice, as the two gases cannot be kept in the necessary proportions, nor at the necessary rates of travel, except at heavy cost in apparatus and skilled supervision. It is here that the peculiar merit of the new process lies; for whatever escapes from the sulphur chamber passes through a scrubber, where a flow of sulphite of iron is encountered. If now the sulphuretted hydrogen should be in excess in the waste gas, this sulphite of iron absorbs it; sulphur and sulphide of iron being ultimately produced. But if the gas changes and the sulphurous acid should be in excess, the sulphide of iron will absorb it—iron thio-sulphate being produced as a result of the reaction; and this, in its turn, will absorb the sulphuretted hydrogen. Thus, both the forbidden gases are dealt with in a practical manner, which is, to all intents, automatic. Moreover, it will be seen that the reciprocal reactions of the two gases on the iron liquor places in the hands of the gas manager a means of regenerating the scrubber; a purposed excess of one gas for a time preparing it to deal with the other. Of course, it is supposed that the scrubbing towers are in duplicate;

so that, when such operations are in progress, the escaping gas is dealt with by the second tower.

The sulphite of iron is prepared in a small attachment to the plant, into which sulphurous acid gas from the sulphur burner is led. It there meets with some ammonia, which is diverted or else drawn from the pipe leading to the saturator. Sulphite of ammonia is thus made, and is run to a tank into which a solution of sulphate of iron or green copperas is put. Sulphite of iron and sulphate of ammonia are at once generated; and the liquor containing the former, in suspension as a fine precipitate, is pumped to the tops of the scrubber columns, down which it runs as usual, meeting the ascending gases.

If sulphuretted hydrogen chances to be the gas in excess, sulphur is liberated, and sulphide of iron is formed. If sulphurous acid meets these products, then iron thio-sulphate is produced. This acts in a similar way to the iron sulphite; and it has been found by actual experiment that these reciprocal reactions can be repeated again and again, and then show no sign that the end of the series had been reached.

It will, therefore, be easily seen that the iron salt is capable of precipitating many times its weight of sulphur, or (to put the matter in another way), can destroy an enormous volume of the offensive gases with which sulphate of ammonia makers and others are troubled.

The advantages of the process are:

(1) Complete stoppage of the escape of the offensive gases, the escape of which is forbidden by the Acts of 1881 and 1892.
(2) The recovery of valuable products.
(3) The above are attained at a minimum of expense by the use of materials always to be found on gas-works and sulphate of ammonia works; and these are of the cheapest kind.
(4) The apparatus is simple and not costly.
(5) The process is self-adjusting, whatever the relative proportion of the gases.
(6) These objects can be attained without the burning of any of the gas.
(7) The products are sulphate of ammonia, sulphur, and a mixture of iron sulphide and sulphur, which can be used as a source of sulphurous acid for the use of the apparatus; the oxide of iron resulting may be re-converted into sulphate, if thought desirable.
(8) The sulphur obtained contains no arsenic. It is thus suitable for use as a source of sulphuric acid for sulphate of ammonia making, and for other technical purposes where freedom from this impurity is necessary.

It will, of course, be obvious that in large works where vitriol plant exists, the sulphurous acid required by the plant can be drawn from the pyrites kilns, and in such cases no brimstone burner will be wanted.

GAS FOR JEWELLERS' WORK.

At a Meeting of the Society of Arts last Wednesday week, Mr. H. H. Cunynghame, C.B., read a paper on "Furnaces Suitable for Jewellers' Work, Enamelling, Art Casting, and Similar Industries," in the course of which he made the following remarks on the use of gas as fuel for the purposes alluded to: "In order that gas may produce light, it is necessary that a supply of incandescent matter should be given to it. But when the gas is to give heat, then what is really required is a good supply of air; about 10 cubic feet of air being wanted for each cubic foot of gas. In order to get the best results, the air must be thoroughly mixed with the gas. This mixing is not at all easy to effect. Air simply put in the same receptacle with gas takes a considerable time to mix. The commonest method of mixing is in ordinary bunsen burners. In this case, the gas is supplied through a small orifice at the bottom of an open tube. As it rushes out in a jet, it draws with it a stream of air, which ought to be about ten times its volume. As the gas and air traverse the tube together, they become partly mixed. But they do not mix completely. The gas takes more air from the outside of the flame. The mixing is greatly facilitated if the jet of gas rushes violently. A small jet at a high pressure is what is wanted, so as to cause a good whirl of gas and air, and mix them together. That is the reason why a blowpipe is so hot. In that case the air and gas become thoroughly mixed, and a hot flame is the result. In Fletcher's gas muffle-furnaces a short chimney is added to increase the draught of air. If the chimney were too long, the draught of air would be too great, and then the flame would be unduly cooled. You want only 10 feet of air for each foot of gas, and you want them thoroughly mixed. If the flame plays into a corrugated receptacle, much good is done in aiding the air and gas to mix, and a hotter flame is the result." In the course of the discussion on the paper, Mr. Fletcher said he thought Mr. Cunynghame's furnace was the best he had seen during an experience of 25 years. One of the great disadvantages of gas-furnaces was that many of them required a blast or else a very big chimney and a large supply of gas, which Mr. Cunynghame had reduced to the minimum. He noticed that the flame had two outlets, and from his experience in experimenting with various gas-furnaces of this character, he found considerable difficulty owing to the shape of the roof, the distance between the roof and the furnace, and the outside of the muffle. The formation of the roof in the furnace shown was a very great advantage.

THE PROGRESS OF GAS LIGHTING.

At a Recent Meeting of the Architectural Section of the Philosophical Society of Glasgow, a lecture on "Lighting" (chiefly by gas) was given by Mr. Isaac Low. The following are some points from the lecture, which was fully illustrated by apparatus and experiments, as well as by a series of lantern slides.

Mr. Low began by remarking that, like everything "across the pond," gas is to be had there on a large scale. Mr. Carnegie spoke of one well of natural gas with a yield of 30 million cubic feet in 24 hours at a pressure of 500 lbs. He (the speaker) had himself seen a blower of natural gas near Kirkintilloch when he was much younger; and he then went on to speak of Dr. Clayton's appearance before the Royal Society, and of William Murdoch's experiments with coal gas. He said there was evidence that gas was known to the ancients, even 3000 years ago in China, and gas-works were still in existence a few miles from Pekin. Natural gas was also known at Hebburn, near Newcastle. Though this gas had been in existence in Pennsylvania for more than a hundred years, it had only just been put to use. He remembered many years ago a display of limelight in Glasgow; but although most wonderful in its intensity—it would only be about 140-candle power—when compared with electric arc lamps it would seem to be as a mere rushlight to an incandescent burner.

The lecturer said he did not propose to describe gas making, but instead he showed on the screen a slide of a small gas-making plant. He dealt first with the quality of the gas, pointing out that it depended largely upon the kind of coal used in making it. A richer gas was produced in Scotland than in England; but the tendency in the former country was to reduce the candle power by using other coals than "parrot" coal. He described at some length the action of the various forms of photometers—Letheby's, Sugg's, Count Rumford's, and others—showing them by limelight; and explaining how the candle power is determined. He also explained the meaning of the term "pressure," and gave numerous illustrations of 22-10ths, 8-10ths, and 25-10ths, &c. Governors by Peebles and others were shown and described by limelight; and at this stage the lecturer paid well-deserved compliments to the late Dr. Wallace, for his professional labours in connection with the Glasgow Gas Exhibition of 1880.

The price of gas was next considered. Mr. Low said that in 1832 it was 12s. per 1000 cubic feet in Glasgow, while it was now reduced to 2s. 1d. for the same quantity; and he likewise dwelt on the diameter of gas-pipes to be used. Some gas managers now issued instructions to gas-fitters, which the lecturer considered showed a deplorable state of affairs in these days of technical education. Some thirty or forty years ago they might have been needed; but that the necessity for their preparation should now be felt he thought was truly puzzling.

Gas-burners came in for a large amount of consideration; regenerative lamps—Siemens, Wenham, Bower, and others—and the governing thereof being specially dwelt upon. The history of the development of burners generally, such as show burners, the union-jet (which the lecturer said had never been surpassed for an open-flame jet), and the argand was traced. Mr. Low paid a compliment to Mr. David Terrace, putting on the screen a diagram prepared by that gentleman to show at a glance the different candle powers obtained from gas burned under varying circumstances. He said the regenerative lamp was really a very fine and delicate instrument; but the gas supply must not vary. Still, these lamps were troublesome, and did not seem to be retaining the excellence they had at first. The lecturer went on to say that the next great improvement was the incandescent light, which marked an era in gas lighting. Having described the process of preparing the mantles, he went on to refer to their life. At this stage he gave considerable prominence to the work done by Professor Lewes.

The next matter dealt with was the heating power of gas and how to determine it; and then the lecturer gave a full account of acetylene, from its discovery by Dr. Edmund Davy, down to the present day. He enlarged upon the installations of acetylene for villages in the country—showing on the screen a gas-works for 2000 consumers, and various generating machines. He then compared the cost of acetylene gas with Glasgow gas at 2s. 1d. per 1000 cubic feet. He made it out to be double the price; but he considered it had a great future under varying circumstances. As to its being subject to explosion, he remarked that the explosions which had occurred had all been due to avoidable causes; at the same time they had done much to prevent a more general use of this convenient artificial light.

Much interest was imparted to Mr. Low's remarks by some questions put by a member of the Society who is also a member of the Town Council, and the Convener of the Committee who will shortly go on their travels to see what other cities and towns are doing in the way of getting up and maintaining a good and efficient light for the inhabitants.

A COMBINED COAL AND WATER GAS PLANT.

Mr. Walter R. Jones's Patent.

Last March, Mr. Walter R. Jones, formerly the Engineer of the Rome Gas-Works, applied for, and was granted, a patent No. 5781) for "Improvements in, and relating to, the Manufacture of Gas," some features of which are worth bringing into greater prominence than would be given to them if appearing in our usual "Register of Patents."

The invention relates to a method of, and apparatus for, obtaining illuminating gas by mixing ordinary retort gas with water gas. Numerous attempts have, says the patentee, been made—attended with more or less success—to mix "blue water gas" with coal gas, during its usual course of manufacture, with a view to increasing the volume of the gas without deterioration of its illuminating value. Up to the present time, however, he considers that no reliable or practical results have been attained in thus treating the total output of coal gas with water gas so as to render the mixture permanent and incondensable. As a consequence, his proposal "for dealing with coal gas in any quantities during the ordinary course of manufacture" is to cause it to combine with a large proportion of freshly produced water gas, while both are at a high temperature—thus taking up and rendering fixed the hydrocarbons which ordinarily form the tar which collects in the hydraulic main.

Three methods of carrying the invention into effect are described and illustrated. According to the claims, the process consists in mixing retort gas with water gas at a high temperature, and subsequently superheating the mixture, whereby the hydrocarbons are rendered fixed and incondensable. The apparatus for carrying out the process is composed of one or more water-gas generators, into which crude retort gas is introduced and caused to mix and combine with the freshly-made water gas, and one or more heated chambers, in which the mixed gases are superheated, whereby the hydrocarbons are fixed in gaseous form and rendered incondensable. The gas-generators are placed adjacent to one or more relatively large retorts and one or more superheating chambers, into which mixed gas from the retorts and generators is conducted.

In the first method adopted for carrying the invention into effect, three producers A, A^1, A^2 are connected on their inlet sides to the gas-main S, which leads from the benches of retorts, and on the outlet sides the three producers are in connection with chambers B, B^1, B^2, filled with chequered brickwork or other materials adapted to store heat. The producers are provided with the usual air-blow connections N, N^1, N^2; and the steam-blow connections O, O^1, O^2, which lead into the space P below the grate Q. The retort gas is drawn from the main S by the steam-exhauster T, and forced through the pipes H R and valve K into the producer A. Before this has been done, however, all the producers (or those of them which it is desired to use), should have been set in operation; and the gaseous fuel thus produced should have been used to heat the chequered brickwork in the chambers B, B^1, B^2. When this has been done, the process continues. The coal gas enters at K, and unites with the newly-generated water gas. The coal gas and water gas are thus intimately mixed, and raised to a high temperature. The mixture then passes off through the outlet V and pipe V^1, and into the lower part of the fixing-chambers B through the valves C. Here the high temperature of the brickwork further heats the mixture, and causes the coal gas to combine with a large proportion of the water gas—thus taking up and rendering fixed the various hydrocarbons which, in the ordinary process, are deposited with the tar in the mains before the gas has been condensed and purified. The gas then passes from the fixing-chambers B, through the automatically-controlled valve D, to the pipe E, which leads to the condensers, purifiers, and the gas plant.

If the producer A^1 should be required to be charged, and the fixing-chamber B^1 to be heated, while the operation was to continue in the manner described in the generator A and fixing-chamber B, the following valves would require to be opened and closed: First close the valve K and the steam-valve O^1; then open the vent at the top of the chamber B, charge the producer A, and blow air in at N. By this operation, the corresponding valves in the producer A will open simultaneously—the valves being interlocked. The valves D, D^1, and D^2 are automatically opened and closed by the rise and fall of the pressure of gas on the inlet side. Only two producers, with their respective fixing-chambers, are in operation at the same time—one generating water gas, and the other producer gas. These operations go on alternately in the two active producers, while the third producer is shut off for clinkering or repairs.

The steam-valve O is open when the producer is in action; while the valve C is always open, to allow the mixture to pass into the fixing-chamber B. The fixed gas flows along the pipe E to the condensers, scrubbers, and purifiers, and to the other gas plant—to be treated in the usual way.

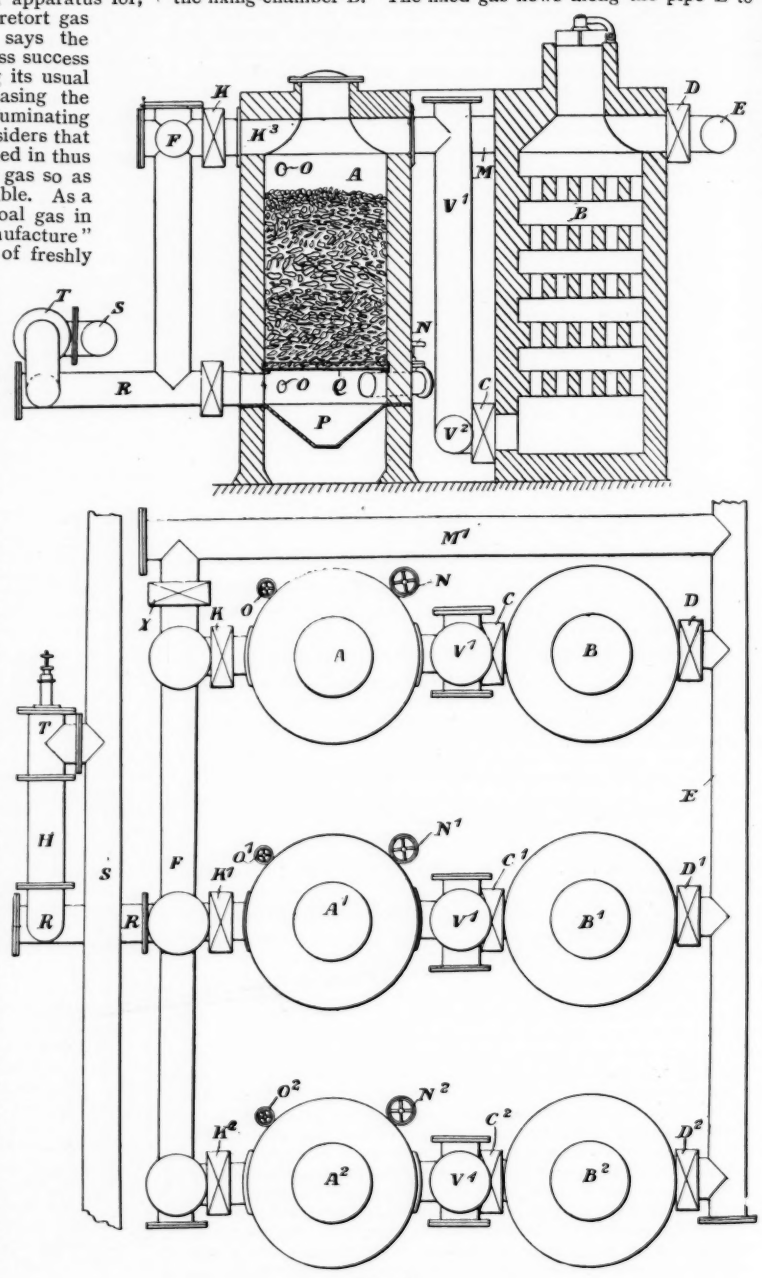


FIG. I.

The second method of carrying the invention into effect is to cause the coal gas from the pipe S to be blown through the exhauster T and the pipes H and R into the chamber U, which has been heated previously by means of the producer gas from the generators. Simultaneously with the blowing of coal gas into this chamber, freshly-made water gas is also introduced from the producers. The water gas passes through openings K^3, valves K, K^1, K^2, and the pipes F and F^1. The gas passes along the pipes R, joins the coal gas before entering the hot fixing-chamber U, where the mixture is fixed as described in reference to the first method, whence it passes off, through the valve Y, to the general delivery pipe E leading to the usual gas-purifying plant.

In this (as in the first-described method) only two generators are active at one time; and, as before, the active generators work alternately as water-gas generators and producer-gas generators. When any of the generators are being used as producer-gas generators, the gas as made passes into an annular combustion chamber surrounding the fixing-chamber U; and here the producer gas is burned and utilized so as to maintain the chamber at a high temperature.

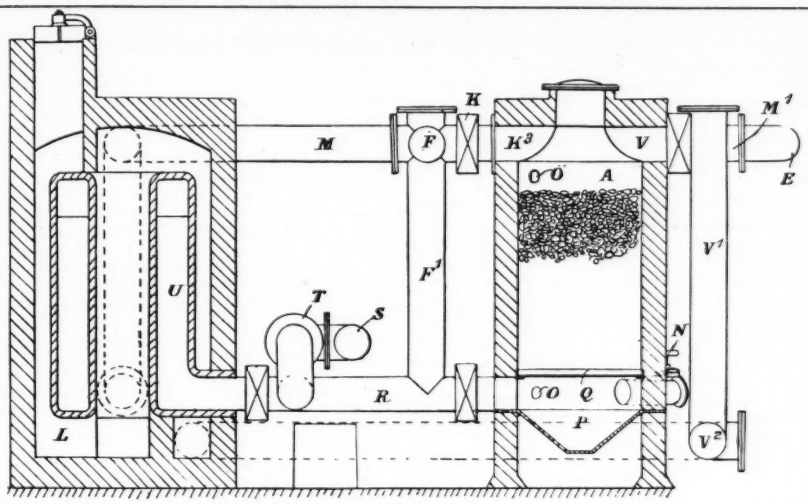


FIG. 2.

As in the first-described method, the valves of the different producers are interlocked, so that the opening of valves on one producer simultaneously closes the corresponding valves on the other active generator. The third generator is shut down to allow for clinkering or repairs, as before.

It will be seen that the first and second methods described can be used in connection with any existing benches of retorts. In the third method of carrying the invention into effect, the producers are placed in close proximity to the retorts; and producer gas is utilized to heat the retorts and effect the distillation of the coal. As before, the generators A, A¹, A² are

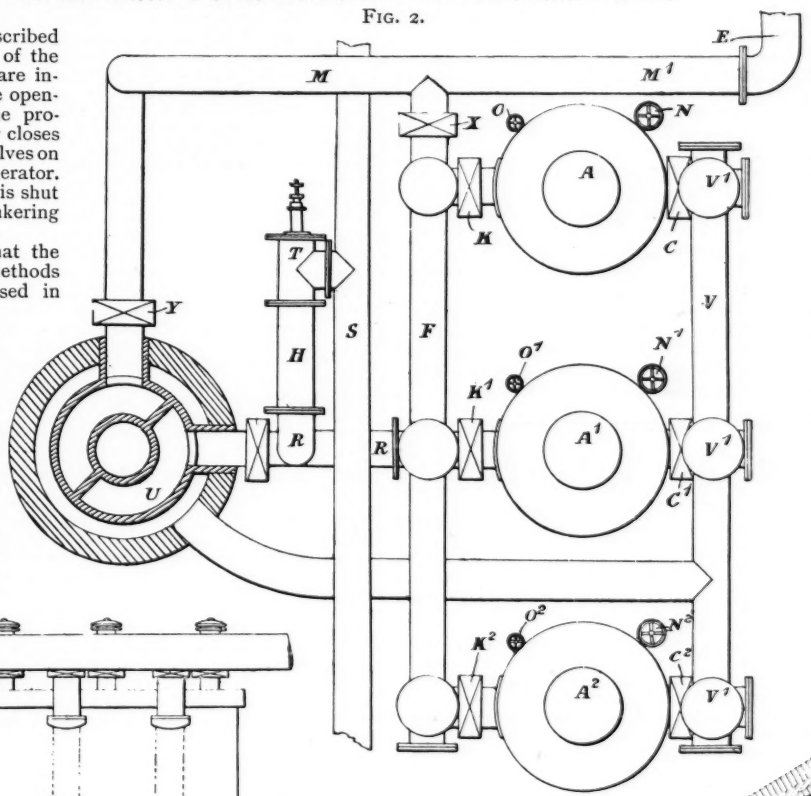
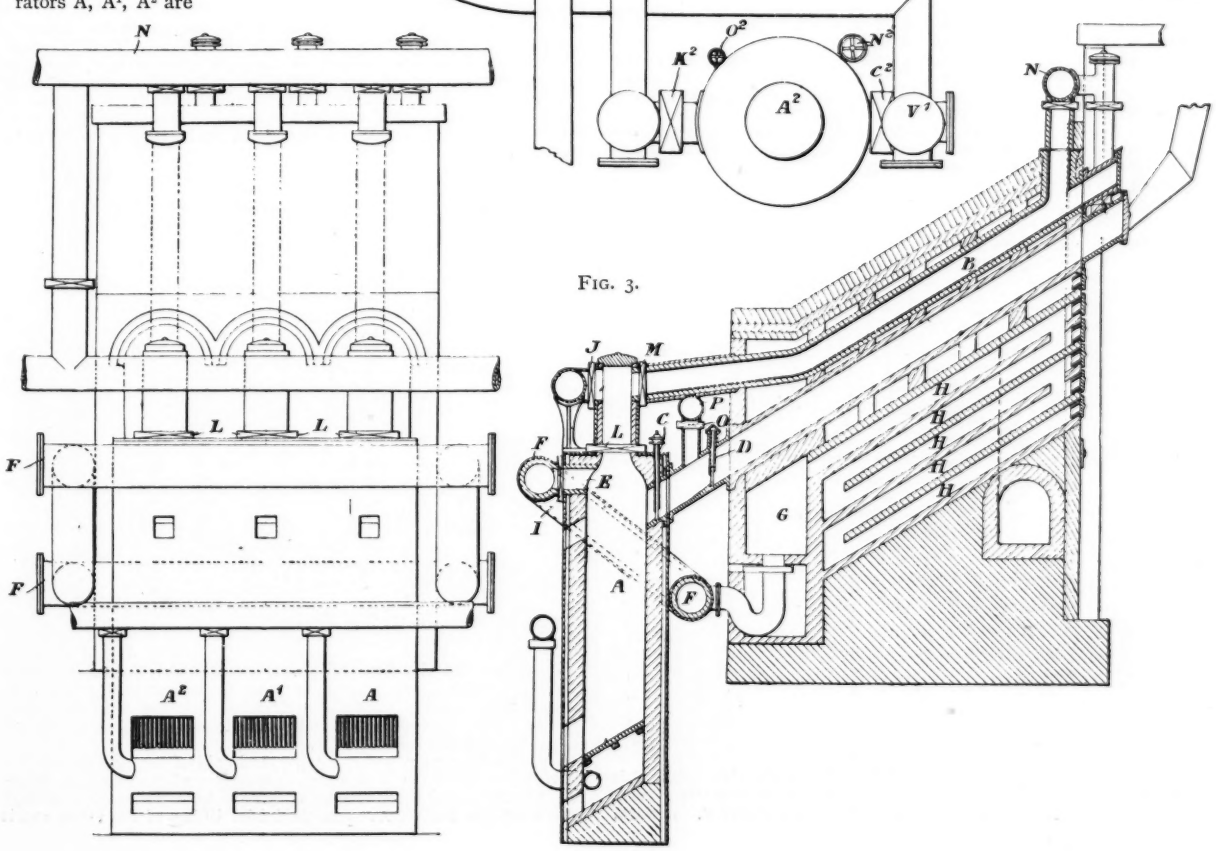


FIG. 3.

in connection with the inclined retorts shown; and the fixing-chambers B, B¹, B² have a complete arrangement of piping for by-passing and isolating as desired. The retorts are of considerably greater capacity than the ordinary retorts; and they may, says the patentee, advantageously be made three to nine times the capacity of the ordinary retorts—determined by the output of gas desired. The retorts are controlled by a valve C. D is a stop to prevent the coal from sliding. By providing three producers in this manner, the process may be made continuous by suitably by-passing and isolating the different producers, retorts, and fixing-chambers necessary to effect the result desired.

The producers operate firstly as poor-gas generators, and, secondly, as water-gas generators. When operating as poor-gas generators, the poor gas is used for heating the retorts and fixing-chambers B. In this case, the valve C is closed and the poor gas passes out from the producer, through the opening



E and fire-brick lined pipe F, into the combustion chamber G; the air needed to support combustion being supplied through secondary air channels H. The heat of combustion of the gases is thus utilized to effect the distillation of the coal and to heat the fixing-chamber B. When operating as a water-gas producer, the water gas is mixed with the retort gas in the upper part of the producer, and the mixture passes to the fixing-chamber B. In this case, the valves I J are closed, and the valves K, L, M are opened; so that the mixed gases are caused to flow through the fixing-chamber B to the main N.

The different retorts in the bench can be isolated by the valves O while they are being charged; the pipe P establishing connection between the other retorts in the bench and the producer which is in immediate connection with the retorts being charged.

In the second and third methods, the water gas should not, says the patentee, be allowed to cool before mixing with the retort gas. Where there is some distance between the fixing-chamber and the generator, it is preferable to pass the gas as soon as generated into heated chambers in the mixing main, so as to prevent condensation of the hydrocarbons which ordinarily unite with the tar which collects in the mains before the gas has been condensed and purified. In all cases the temperature of the mixture should be maintained high, and the water gas introduced to the coal gas at a high temperature. Hence, it is preferable to mix the coal gas with freshly-made water gas. In the first method, if the temperature of the mixture of the coal and water gases is sufficient to ensure fixing, the mixture may be short-circuited from the producer to the main which conducts the fixed gas to the condensers, purifiers, and other plant, and need not be passed through the fixing-chamber as described above.

The temperature of the fixing-chamber should not, it is mentioned, be allowed to rise too high, as this would cause the disintegration of the carbon and hydrogen in the illuminating gases; but the temperature must be sufficiently high to vaporize the tarry oil, and so cause the free hydrogen in the water gas to unite with the carbon in the tar to form a permanently fixed gas with high illuminating property. After this, the fixed gas is, of course, treated in the usual way for the extraction of the residue of the tar and ammoniacal liquors.

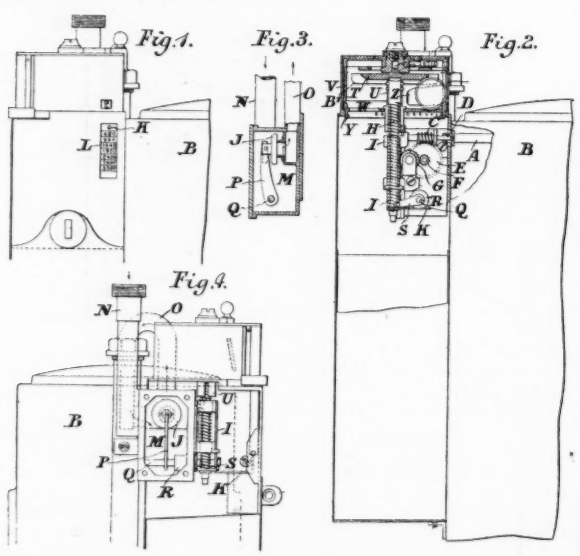
Should the water gas in either of the methods exceed in quantity that necessary to take up the production of coal gas and its tar vapours, a quantity of oil distillates may, it is pointed out by the patentee, be injected into the fixing-chamber or other parts of the apparatus where deemed most desirable.

REGISTER OF PATENTS.

Coin-Freed Gas-Meters.—Carter, G., of Holloway, N., and Parkinson, W. C., of City Road, E.C. No. 28,720; Dec. 29, 1902.

This invention has for its object to construct a coin-freed attachment that shall be readily applicable to existing ordinary gas-meters so as to convert them into coin-freed meters.

Fig. 1 is a front elevation of the coin-freed attachment shown fixed in position on the side of a meter. Fig. 2 is a sectional elevation of the attachment with part of the meter broken away to show the connection between the coin-freed and the meter mechanism. Fig. 3 is a sectional detail of the valve-chamber and valve of the attachment to which the gas inlet and outlet pipes are connected. Fig. 4 is a side elevation of the upper part of the attachment and meter with part of the casing and cover of the valve-chamber removed.



The coin-freed mechanism shown (adapted to work with shillings) is operatively connected with a spindle A driven through worm gearing from the units shaft of the index mechanism of the meter B. A worm spindle C is detachably coupled with the spindle A by the pin and slot connection D; and it drives a vertical worm wheel E geared through toothed wheels F G with a vertical screw H. The screw is connected with, and actuates, a sliding plate I, which is raised and lowered with the screw, and operates the gas-inlet valve J and the pointer K that moves over the scale L and indicates what quantity of gas is to the credit of the user. As shown in figs. 3 and 4, the gas-inlet valve J is enclosed in a chamber M, to which the inlet and outlet pipes N O are connected. The valve J is carried by an arm P on a spindle Q projecting through a stuffing-box R to the outside of the chamber, and with its end in proximity to the screw H. When the screw, which is caused to slowly ascend by the action of the meter, approaches its highest position—carrying the plate I with it—a pin carried on an arm S fixed to the outer end of the spindle Q engages in a notch in the lower end of the plate; and the plate continuing to ascend, closes the valve.

The screw H is lowered or set back a predetermined amount for each coin inserted; and for this purpose it is connected with the coin-receiving mechanism, which comprises a ratchet-wheel T provided on its underside with a sleeve U, which surrounds the upper end of the screw, and is slotted to receive pins which connect the screw and sleeve together and enable the sleeve to rotate and thus traverse the screw without traversing itself.

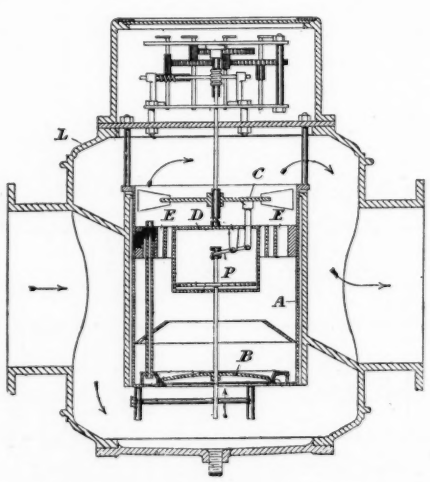
The coin-receiving mechanism comprises a vertical fixed cylinder coaxial with the vertical screw, provided with a coin-inlet slot and closed at its lower end with an adjustable disc Y having a coin-outlet slot W. The disc is provided with a scale and perforated flange, and adapted to adjust the coin outlet, and thus control the quantity of gas to be delivered for each coin. The coin-receiving mechanism also comprises a ring shield V, coaxial with the vertical screw, and bearing at its bottom end on the disc Y.

A coin-pocket Z, formed in the shield, receives the coin inserted through an inclined slot in the wall of the cylinder, and engages one of a series of notches formed between the teeth of the ratchet-wheel T—thus coupling the ratchet-wheel and coin-pocket Z together. The pocket is formed wider at the top than at the bottom, to enable it to be moved slightly after the insertion of a coin without moving the ratchet-wheel. The independent initial movement is employed to effect the release of the ratchet-wheel, which is locked when the coin slot is open by a pawl pivoted on the cylinder cover and engaging in the teeth of the ratchet-wheel. In this position of the pawl, an inclined projection on it is lowered into a notch with inclined ends formed in a ring fixed concentrically within the shield V. By this initial movement of the pocket, the ring, which also moves with it, acts, by means of the inclined edges of the notch, to raise the pawl, which then rides on the ring, and is held out of gear during the movement of the ratchet. During the initial motion allowed by the wide pocket, the shield V closes the slot in the cylinder, and thus prevents any tampering with the mechanism.

Rotary Gas-Meters.—Thorp, T., of Whitefield, Lancs. No. 2029; Jan. 28, 1903.

This is an improved rotary gas-meter of the kind referred to in Patent No. 20,214 of 1901, and consists in providing means for better controlling the flow of gas through the casing underneath the fan-wheel, and for preventing the over-running of the fan when the gas supply is suddenly shut off.

In the arrangement of meter shown, the gas enters the casing L and passes through a lightly-loaded valve B, and then upward through a baffle-plate D having passages E round its outer margin, by which it is directed on to the blades of the turbine or fan-wheel C, and thence to the outlet. The measuring and indicating mechanism of the meter is all carried in and by a cylindrical casing A, which is so fitted into the casing L of the meter that it can be readily removed and replaced.



There is a central cylindrical chamber into which the valve spindle passes through a clearance hole; and the disc is fixed to this spindle so as to lie near to the bottom of the chamber when the valve B is upon its seat. The chamber is sufficiently deep to allow the disc to rise and fall freely with the valve spindle.

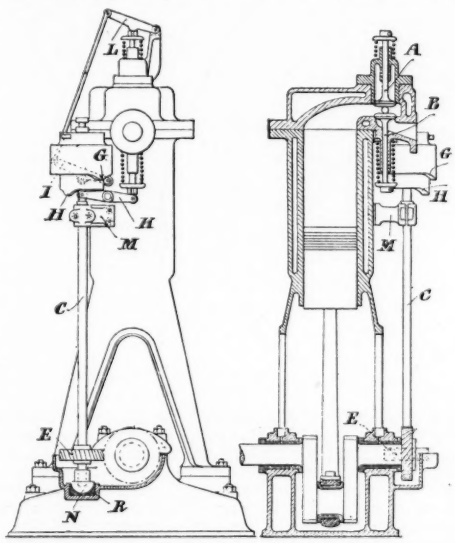
The conical ring round the valve seating is of such depth that the valve B can rise above it when full open. Round the ring is an annular chamber; and there are holes into it from the inside, through which the gas first passes upon the initial lifting of the valve, and is

conducted through the outlet tube and directed on to the vanes of the turbine or fan-wheel C.

In the arrangement shown for preventing the over-running of the turbine wheel or fan disc C, P represents the lever which is fulcrumed to a bracket, and engages at one end with collars upon the valve spindle. The rod articulated to the other end of the lever has its free end formed as an equivalent of a brake shoe.

Gas-Engines with Four-Stroke Cycles.—Meyer, P., of Halle a/S, Germany. No. 11,942; May 25, 1903.

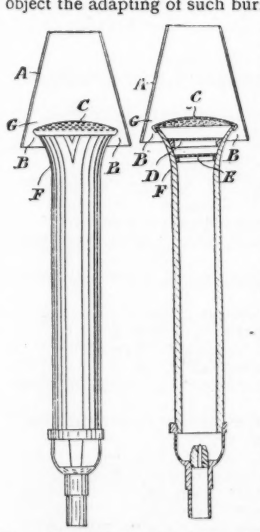
This gas-engine, of the four-cycle vertical type, has its cylinder mounted above the crank-shaft, with a combination of superposed coaxially mounted inlet and exhaust valves arranged laterally of the combustion chamber, levers for operating one or both of the valves, rolls on the levers, and cam cylinders to operate the levers—the cam cylinders being mounted on a vertical spindle driven from the crank shaft by means of spiral wheels. As shown, the inlet and exhaust valves A



B (mounted vertically one above the other coaxially) are at the side of the cylinder. One or both of the valves are operated by cam surfaces G H, of hollow cylindrical or annular form, mounted on the upper part of a vertically-disposed rotary spindle C. This latter is supported in an upper bearing M, and its lower end (rounded at N) is supported in a socket R mounted on the bed of the engine. This arrangement enables the spindle to be tilted in its lower bearing after the upper bearing M has been detached; so that the whole spindle, together with the parts attached to it, may be removed from the engine for cleaning or repairs. The spindle C is rotated from the crank-shaft by screw or spiral gearing E F; the former being keyed to the spindle, the latter to the crank-shaft—the spindle being driven at half the speed of the crank-shaft. The exhaust valve B is operated by the cam H by means of the pivotally supported rocking arm K; while the inlet valve A is worked from the cam G by the pivotally-supported rocking arms I L and connecting rod.

Bunsen Gas-Burner.—Davies, E. & D., of Pontypridd. No. 17,319; Aug. 10, 1903.

This invention relating to burners of the bunsen type has for its object the adapting of such burners "to obtain a flame of greater and more constant intensity with a comparatively low pressure and low consumption of gas." Hitherto in such burners, the patentees say, the full intensity of the flame has been of short duration, and the consumption of gas wasteful, "owing chiefly to the heat of the burner decomposing the gas before combustion, and to the high pressure used." But, by preventing the conduction of heat from the lower nozzle of the burner to the upper end of the mixing-chamber, and by making the latter of some heat non-conducting materials (such as asbestos and porcelain), and by forming the latter with a bell-mouth shaped outlet to accord also with the pressure of gas—which latter is determined by the size of the flame required—these defects are overcome.



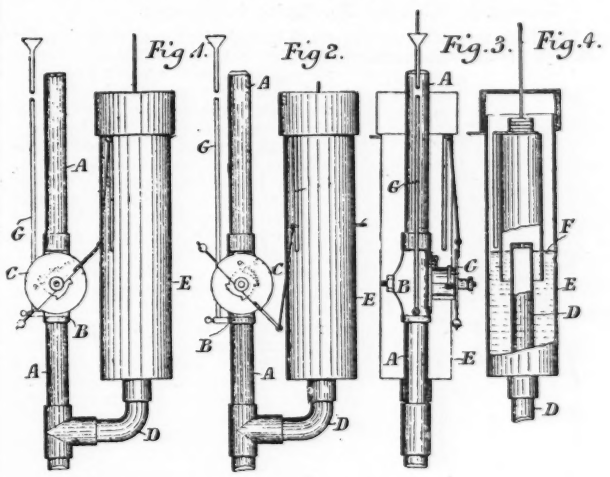
The illustration represents the burner placed near the receiving pipe of a gas-heating apparatus. There is fixed on the upper end of the mixing-chamber F a perforated metal cap; and, if required, there may be more than one of the latter placed inside of the upper end of the mixing-chamber (as D and E). The metal caps C, D, and E prevent the gas passing out of the mixing-chamber too rapidly, and also allow the gas and the air to be properly mixed in the mixing-chamber. The upper end of the mixing-chamber, where the cap is placed over it, is slightly inside the receiving pipe, to allow for the air to pass between the pipe and the mixing-chamber (as at B). When the gas is to be ignited, it may be lit from the cap G if desired.

Automatically Lighting and Extinguishing Street and other Gas-Lamps.—Bergan, J., of Granville, New South Wales. No. 22,099; Oct. 13, 1903.

This apparatus is designed for lighting and extinguishing the street-lamps throughout an entire district, by means of a device actuated from one central station.

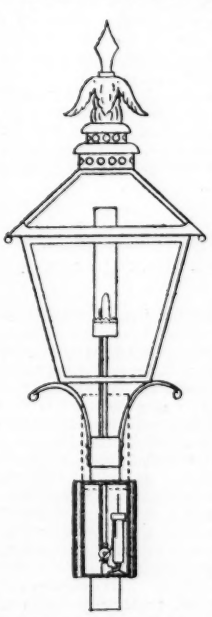
All former attempts to provide such an apparatus have, it is said, failed in the first essential to success—namely, in achieving absolute reliability under the constant variation of pressure inevitable in all gas-mains. But this necessary reliability of action is here claimed to be obtained by actuating a specially constructed tap in the supply-pipe by means of the rise and fall of a small gasholder or motor whose movement is controlled by the alteration of the pressure in the main. In former attempts to apply this principle, failure has resulted (the patentee states) from the liability of the tap used to become stiff—the small power obtainable from the variation of the gas pressure not being then sufficient to operate it. Another essential condition which this invention is said to achieve is that the lamps cannot be either extinguished after being lighted or lighted after being extinguished, by any variation of pressure between the maximum and the minimum previously determined for each lamp, owing to the fact that the apparatus is so constructed that the minimum and the maximum pressures must both of them be recorded before the supply-tap can be operated.

Fig. 1 is a front elevation of the apparatus, showing the position of the tap when the gas pressure is at or above the determined maximum. Fig. 2 shows the position when the gas pressure is at or below the



determined minimum. Fig. 3 is a side elevation of fig. 1. Fig. 4 is a sectional view of the motor. A view of the apparatus in position near the top of a street-lamp post is also given.

A is the supply-pipe; B, a two-way gas-tap with a concentric extension carrying the travelling plate C. D is a branch-pipe carrying the motor and casing, and terminating within the gasholder, just above the surface of the liquid seal. E is a casing containing the motor, the lower portion of which carries the liquid seal. F is a liquid seal, which confines the gas within the motor-bell. For this purpose, glycerine, or a mixture of glycerine and water, would be used. G is a pilot-light, preferably provided with a bell-shaped burner to protect the light from being extinguished by wind.



The method by which the invention operates is as follows: Assuming that in any particular lamp the motor is adjusted so as to require a gas pressure of 27-10ths to lift it, and that it will not descend to its lowest position until the pressure sinks to 20-10ths. Assuming also that the lamp is out and the motor lifted by the gas pressure to its highest point, as shown in fig. 1. It is desired to light the lamp. The pressure at the gas-works is momentarily lowered, so as to cause the pressure in the motor to fall to or below the determined minimum—namely, 20-10ths. The motor then descends to its lowest point; the parts taking up the position shown in fig. 2. This movement causes the operating pawl on the travelling plate C to move forward over the ratchet-collar and engage the tooth thereon next forward of that which it engaged when the parts were in the position shown in fig. 1. The pressure in the main is then restored to (or above) the working maximum (that is, 27-10ths). This increased pressure lifts the motor back to the position shown in fig. 1. The pawl having now engaged a tooth on the ratchet-collar forward of that which it engaged when the

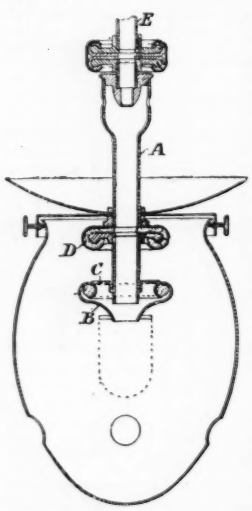
pressure was previously at its maximum, the upward movement of the parts gives the tap plug a quarter turn—thus bringing the aperture into such a position that the gas passing through reaches the flame of the pilot-light and becomes ignited. A repetition of the operation gives the tap-plug another quarter turn, and shuts off the gas supply.

Thus, by merely lowering the pressure at the gas-works to the previously determined minimum, and then raising it to the similarly determined maximum, the whole of the lamps in the district can be simultaneously lighted or extinguished. When the gas is lighted, the pressure may be raised to any degree and reduced to within one point of the minimum, or reduced to any point sufficient to maintain the flame, and raised again to within one point of the maximum, any number of times, without the supply-tap being operated in the slightest. It is only by deliberately performing the double operation of lowering the pressure to the minimum and then raising it to the maximum that the tap is turned and the lamps lighted or extinguished; for it is only when the motor reaches its lowest point that the operating pawl engages a fresh tooth in the ratchet shoulder or collar of the tap, and it is only when the full maximum pressure is applied that the motor will rise and operate the mechanism. As a consequence of this arrangement, ordinary and inevitable fluctuations in pressure do not in the slightest degree affect the supply-tap.

The continued effectiveness of the invention is dependent on the tap maintaining its sensitiveness at all times and under all conditions, and no form of tap heretofore constructed will, it is said, meet this condition. A tap with an ordinary taper plug would not remain effective for more than a few days; but the shoulder provided on the tap plug shown, "if carefully constructed, absolutely prevents jamming, and insures the tap remaining free and sensitive under all possible conditions."

Inverted Incandescent Gas-Lamps.—Hellman, H. W., Arendt, O., and Marcuse, J., of Berlin. No. 22,561; Oct. 19, 1903.

This invention relating to inverted incandescent gas-lamps, has for its object to overcome certain difficulties connected with the cooling of the mixing tube or conduit leading to the mouth of the burner by dividing the mixing-tube into two or more heat-conducting portions separated by layers of insulating material. These heat insulating layers are made of asbestos, thickly felted thread-like slag ("slag-wool"), magnesia, or the like; and similar heat-insulating material, forced in between the two parts of heat-conducting material (such as brass, aluminium, or the like), are provided with metal parts or with flanges, and separated from each other—being arranged in the form of narrow rings, small tubes, or the like. The narrow heat-insulating intermediate layers, on the surface of which two or more parts of the gas admission-tubes of the inverted lamps (shown) are united with each other, may also be formed so as to constitute heat-insulating casings.



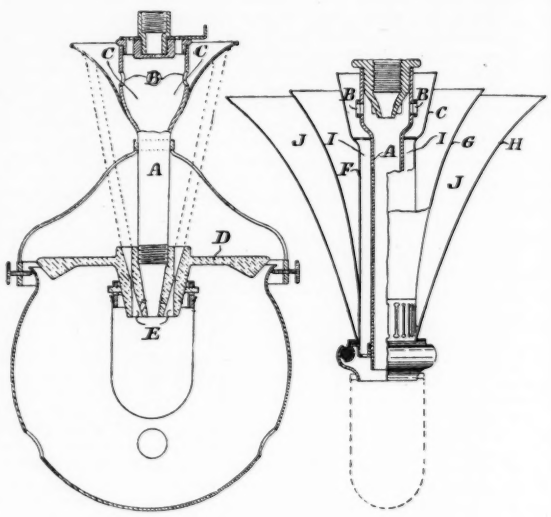
On the inverted lamp shown, the gas admitting-means are interrupted by hree differently composed narrow heat-insulating intermediate layers. Upon the lower end of the two-sectioned mixing and burner tube A, is the burner-head, which consists of two parts united with each other by forcing the rims of the two parts B C around an asbestos ring. The burner-head thus formed for the suspension of the incandescent mantle causes a deflection of the hot gases of combustion from the upper parts of the mixing-tube, and (in view of the heat-insulating action of the asbestos ring) prevents the transmission of heat upon the upper parts of the mixing-tube.

The parts B C of the metal mixing-tube are also separated from each other by a heat-insulating intermediate layer D. A similar insulating casing is provided above the lamp, between the mixing-tube and the gas admission-tube E. This casing (formed by the flanges) is screwed with its tubular ends on to the upper part of the inverted lamp, or to the bracket of the lamp chandelier or the like.

Downwardly-Burning Incandescent Gas Lamps.—Hellmann, H. W., Arendt, O., and Marcuse, J., all of Berlin. No. 22,562; Oct. 19, 1903.

The invention, relating to downwardly-burning incandescent gas-lamps, has for its object to increase the supply of air to the mixing-tube and burner of such lamps, by arranging a system of mantles or screens to cause the hot gases arising from the burner to induce an air circulation. The invention further consists in the special arrangement of deflecting mantle and air-supply openings to increase the supply of air to the mixing-tube. In the first form of construction shown, the admission of air to the burner and to the mouth is so arranged for that the upper part of the mixing-tube A is provided with air admission-openings B radially arranged with relation to the gas nozzle as well as with air openings vertically arranged in the side of the gas nozzle. The mixing-chamber is surrounded by a screen C (open at the top, and of larger diameter at one end) connected to the mixing-chamber below the radial air admission-openings B. At its top, the mantle is preferably covered with wire gauze, which, though not preventing the access of air, protects the interior of the mantle from dust and dirt. To the lower end of the mixing-tube a burner-head is attached, preferably made of refractory, heat-resisting material, and which is extended to form a screen D or otherwise connected to the screen. In the direction of the gas-escape opening, the burner-head is provided with a number of perforations or small tubes E, which open out into the upper surface of the burner-head, and on the other end into the interior of the downwardly-directed mantle.

In consequence of the arrangement of the air admission-openings in the upper part of the mixing-tube, both radially as well as axially in relation to the gas-nozzle, a considerably increased supply of air to the interior of the mixing-tube A is produced. The screen C deflects the air which has been sucked in in a radial direction; and the air is thereby compelled to enter into the interior of the mixing-chamber without being decreased in volume. The currents of air which by this



means are sucked in into the interior of the mixing-chamber at right angles to each other, "are capable of effecting a considerable increase of the amount of air and a most intimate mixture of the illuminating gas with air." By this means, an exceedingly non-luminous and hot flame is said to be produced, while the entire mixing-tube is kept cool by the extension or plate D screening off and deflecting the hot gases of combustion which rise from the mouth of the burner.

In the second form, the mixing-tube A is surrounded at its upper part with a screen C, which is, however, extended at its lower end to form a tube F, which surrounds the greater part of the mixing-tube at a certain distance, instead of the small tubes shown in dotted lines in the former construction. To this tube are connected two screens G, H, which are enlarged towards their upper ends so as to present a funnel shape. The tube F is provided at its lower end with perforations of any suitable configuration, which constitute a connection between the air-chambers I and J.

APPLICATIONS FOR LETTERS PATENT.

27,259.—Park, J. R., "Incandescent burners." Dec. 12.
27,279.—Reinhardt, L. J., "Gas-burners." Dec. 12.
27,283.—Biermann, F., "Gas and water meters." Dec. 12.
27,292.—Horsfall, J. E., "Charging and discharging retorts." Dec. 14.
27,307.—Rolloson, A., "Gas-engines." Dec. 14.
27,319.—Lewis, J. J., and Akkeren, L. J. J. v., "Gas-Engine." Dec. 14.
27,350.—Le Tall, F. W., "Gas or vapour lamps." A communication from H. N. Potter. Dec. 14.
27,390.—Stevens, J. H., and Jones, H. A., "Bye-pass burners." Dec. 14.
27,413.—Adams, M. J., "Gas-stoves." Dec. 15.
27,462.—Deeley, W. J., "Shades and reflectors for incandescent gas-lights." Dec. 15.
27,473.—Cuttell, T. L., and the Anti-Vibration Incandescent Lighting Company, Ltd., "Incandescent burners." Dec. 15.
27,496.—Mond, L., "Gas-producers." Dec. 15.
27,497.—Duckham, A. M'D., "Lighting burners." Dec. 15.
27,513.—Bickerton, H. N., Bradley, H. W., and Clerk, D., "Internal combustion engine governors." Dec. 15.
27,524.—Haddan, H. J., "Inverted incandescent gas-burners." A communication from the Actien Gesellschaft, formerly C. H. Stobwasser and Co. Dec. 15.
27,536.—Fawcett, P. W., and Robertson, E. F., "Gas-heated furnaces." Dec. 16.
27,543.—Crowther, A., "Couplings for gas-tubing." Dec. 16.
27,553.—Bachrodt, L., "Gas-heating stoves." Dec. 16.
25,571.—Moeller, J., "Incandescent burners." Dec. 16.
27,579.—Delassue, J., "Gas-producers." Dec. 16.
27,593.—Boult, A. J., "Gas-compressors." A communication from M. D. Compton. Dec. 16.
27,643.—Bray, J. W., "Regulating the air supply to atmospheric burners for incandescent lighting." Dec. 17.
27,686.—Harbot, H. F., "Slot-meter check." Dec. 17.
27,688.—Flachshaar, P., "Catalytic gas-igniters." Dec. 17.
27,754.—Horton, W., "Anti-vibrators." Dec. 18.
27,766.—Craig, G., "Gas calorimeter." Dec. 18.
27,791.—Trewby, G. C., "Photometric apparatus." Dec. 18.
27,823.—Wilson, L., "Gas-producers." Dec. 18.
27,861.—Mander, G. G., "Incandescent burners." Dec. 19.
27,937.—Kramer, E., "Suspending incandescent bodies." Dec. 19.

LEGAL INTELLIGENCE.

The Appeals in the Metropolitan Water Arbitration.

In the Court of Appeal, on Monday last week, before the Master of the Rolls and Lord Justice Cozens-Hardy, Mr. C. A. Cripps, K.C., made an application in respect of the above matter. He said that section 23 of the Metropolis Water Act, 1902, provided that appeals on questions of law from decisions of the Court of Arbitration under the Act should come to the Court of Appeal. One case stated for the purpose of bringing an appeal had already been signed and the appeal entered—viz., that of the East London Water Company, for whom he appeared. Others would shortly be entered in the cases of the New River and Grand Junction Companies. It was desirable that the questions raised in these appeals should be determined as soon as possible, as the 24th of June next would be what was called in the Act the "appointed day." His application was that the Court would allow some special time to be arranged for the hearing of these appeals. He did not ask that a day should be fixed, but for leave to apply at the beginning of next sittings to have one fixed. Mr. Freeman, K.C., who represented the Water Board, supported the application. The Master of the Rolls said it was of public importance that these cases should be heard at an early date; and the Court would take steps for fixing a particular time. They would consult with the other members of the Court, and a further application might be made soon after the beginning of next term.

A Water-Rate Assessment Case.

Last week the Chester-le-Street Justices were asked to decide a dispute between the Weardale and Consett Water Company and the landlords of three houses let at a weekly rental as to the basis on which the water-rate should be assessed. The rents paid, including all rates, were 5s. 3d., 4s. 9d., and 4s. 6d. respectively. Mr. Jackson, for the Company, said that under section 45 of the Consett Water Act, 1860, the scale of rates to be paid in respect of domestic property was: For houses up to £7, 10s. a year; £7 to £10, 13s. a year; and £10 to £15, 18s. a year. They had to determine the net annual value, which was the sum coming to the landlord from the houses as clear income after meeting all outgoings. The landlords in this case appeared to take it that the poor-law assessment was the basis on which they ought to pay. He thought the net amount received by the landlords could be proved to exceed £7; and the Company therefore claimed that they should be assessed to pay 13s., and not 10s. On behalf of the landlords, Mr. Turnbull said he could not understand why the Company had brought these cases against his clients, and let off the colliery owners, whose property was rated at a very much lower value. The annual value was the rateable value for poor-rate purposes, as defined by the Parochial Assessments Act. The Company claimed to base their rate on the rent; but he argued that the poor rate was the legal basis. If there was a doubt in the matter, he claimed it for the customers; and as these were test cases, he asked the Bench not to decide on them alone, but to have a larger number of comparative cases before them. After consultation, the Chairman said they had come to the conclusion that the annual values of the respective houses were: £9 1s. 2d., £8 0s. 4d., and £7 8s. 4d. The assessments would, therefore, take effect according to the Company's scale.

Reduction in Price.—The Faversham Gas Company have given notice of a reduction of 3d. per 1000 cubic feet in the price of gas (from 3s. 6d. to 3s. 3d. in the town), to take effect as from the 1st prox.

Gas Purchase Question at Barnard Castle.—The Barnard Castle Urban District Council, at their meeting last week, decided to seek power to supply gas and take over the works of the local Company. Mr. Smith, in opposing the proposal, said he thought it would require £18,000 to purchase the gas-works, and that the amount the Council would need each year would be £842. If therefore the profits of the Company were £750, there would have to be a rate of 2d. in the pound to meet the deficiency. Adding the legal and arbitration expenses, it would mean, he said, a total of 1s. 8d. in the pound on the rates.

The Gosport District Council and the Water-Works.—At a recent special meeting of the Gosport District Council, a letter was received from the Gosport Water Company, in reply to one from the Council, intimating that, subject to the approval of the shareholders, the Directors were quite prepared to sell the undertaking; but before discussing terms, they desired to know if the Council were in a position to buy. Mr. Stanley Blake proposed that a conference should be arranged between five members of the Council and the Directors of the Company, to discuss the question in all its bearings and report; and this was agreed to.

The Registration of Plumbers.—We learn that the Plumbers' Registration Bill which got through the House of Lords in 1902, but failed, in the hands of a private member, to pass the House of Commons, has the full approval of the Local Government Board. It provides for the constitution of a Council composed of 14 members, nominated by the following bodies: Three by the Local Government Board, two each by the Association of County Councils, the Association of Municipal Corporations, the National Association of Master Plumbers, and the National Association of Operative Plumbers, one by the Royal Institute of British Architects, one by the City and Guilds of London Institute, and one by the Worshipful Company of Plumbers. The Council are to frame a scheme for the registration of plumbers, to be approved by the Local Government Board and confirmed by Parliament. The chief object of the Bill is to afford additional safeguards to the public health by encouraging the better training of plumbers, and by enabling persons employing plumbers to select, if they wish, workmen who have given evidence of their qualification to carry out satisfactorily work in connection with sanitation and the public water supply. The Bill embodies the conclusions arrived at at the conference convened by the Plumbers' Company a few weeks ago.

MISCELLANEOUS NEWS.

PROPOSED GAS LEGISLATION FOR NEXT SESSION.

By the courtesy of the Agents for the various Bills relating to gas and water supply which have been deposited for next session, we have been furnished with prints, which will enable us to commence in the next issue the usual articles indicating the chief features of the measures. In the meantime, we give a few particulars of some of the most important of them.

Gaslight and Coke and other Gas Companies' Acts Amendment Bill.

The Bill promoted by the London County Council to amend the Gaslight and Coke and other Gas Companies' Acts Amendment Act, 1880, sets forth, in the preamble, that under that Act the Gaslight and Coke, South Metropolitan, and Commercial Gas Companies were made liable to forfeitures for defective illuminating power, excessive impurity, or insufficiency of pressure. Under section 12, if a Company think themselves aggrieved by the report of a Gas Examiner, they may appeal to the Chief Gas Examiner, whose decision, after hearing the parties, is to be final and conclusive. By section 18, the report of the Chief Gas Examiner on appeal, or that of the Gas Examiners should no appeal have been made, is to be evidence of liability to a forfeiture. Doubts having arisen as to these provisions of the above-named Act, the promoters deem it expedient that they should be amended; and this they propose to do in the following way: Section 12 is to be repealed, and in lieu thereof the following provisions are to have effect:—

If the Company think themselves aggrieved by any report of a Gas Examiner, they may, within seven days after the day on which that report is delivered to the Company, appeal to the Chief Gas Examiner, whose decision, after hearing the parties, shall be final and conclusive; and the Chief Gas Examiner shall forthwith report every such decision to the controlling authority and to the Company: Provided always that the Chief Gas Examiner may give a decision under this section without hearing any party who shall fail or neglect to attend before him after receiving not less than seven days' notice of the time and place fixed by the Chief Gas Examiner for hearing any appeal under this section. If in any case the Company do not appeal as aforesaid, or if, having appealed, they withdraw the appeal, the report of the Gas Examiner shall be final and conclusive.

In the event of a Company appealing to the Chief Gas Examiner and then withdrawing the appeal, they are both to give notice to the controlling authority. For section 18, it is proposed to substitute the following provision:—

The report of a Gas Examiner (in cases where there is no report of the Chief Gas Examiner) showing a case of defective illuminating power, excessive impurity in, or insufficient pressure of, the gas supplied by the Company, or in cases where there is a report of the Chief Gas Examiner showing such a case as aforesaid, such last-mentioned report shall be conclusive evidence of the liability of the Company to a forfeiture in respect thereof.

Proceedings against a Company in respect of any forfeiture incurred under the Act of 1880 or the intended Act may be taken at any time within six months after the date of the report of the Gas Examiner, or that of the Chief Gas Examiner on appeal; or in the event of the Company appealing and then withdrawing, within six months from the date of the receipt of notice of such withdrawal. Certain sections of the Metropolis Gas Act, 1860, are to be repealed.

Croydon Gas Bill.

This is a Bill to change the name of the Croydon Commercial Gas and Coke Company to "The Croydon Gas Company," and to confer further powers upon the Company with respect to the raising of capital, and the construction and maintenance of additional gas-works. The preamble shows how the undertaking has reached its present proportions, gives particulars of the existing capital powers, and sets forth the necessity for extending the works to meet the increasing demand for gas. The Company will seek authority to raise a sum not exceeding, with the premiums, £300,000, to be called "D" stock, and to carry 5 per cent. dividend; also to borrow on mortgage, in respect of the "A," "B," and "C" stocks, any sums not exceeding in the whole (inclusive of £37,500 already borrowed, and any premiums to be received) one third of the nominal amount of such stocks. They will further ask for power to borrow on mortgage to the extent of one-third of the additional capital to be authorized. Interest on borrowed money is to be limited to 5 per cent. per annum. It is proposed that from and after Jan. 1, 1905, the sliding-scale in respect of the dividend on the existing capital is to depend on the price in any half year; and the necessary change in the period will be made in the provisions of the Company's Act of 1877 in regard to the insurance and reserve funds, and the application of excess profits. Authority will be sought for the formation of a renewal fund by the appropriation out of revenue in any half year of an amount equal to ½ per cent. on the paid-up capital, including premiums. The other powers sought relate to the construction and maintenance of works, the purchase of lands by agreement, the provision of dwellings for the workmen, and the supply of fittings, &c. The Company desire to be exempt from penalty in the event of failure to supply gas owing to unavoidable cause.

Crystal Palace District Gas Bill.

The object of this Bill is to alter the provisions of the Acts of the Crystal Palace District Gas Company with respect to the illuminating power and the testing of gas, to repeal the existng provisions with regard to the presence of sulphur, and to change the name of the Company to "The South Suburban Gas Company." Clauses 2 and 4 are the most important. The former sets forth that after Jan. 1, 1905, the illuminating power of the gas is to be 12 instead of 15 candles, tested by Sugg's "Wandsworth" burner, in conjunction with the table photometer and the pentane 10-candle lamp. No forfeiture is to be incurred in any case with respect to which it is proved that a defect in illuminating power or excess of impurity was through an unavoidable

cause or accident. If required by any consumers, the Company will supply, at any time within two years from the above-named date, and fix free of charge, instead of any in use, "flat-flame burners adapted for producing the best light obtainable from gas of the illuminating power prescribed." They will also, if requested to do so, "provide and fix in the residential rooms of any house not more than six incandescent burners instead of new flat-flame burners." Clause 4 specifies that the standard price is to be 3s. 2d., with a reduction of 1s. 3d. per cent. in the standard dividend for every rise up to 1d. per 1000 cubic feet in any part of a half year, and an increase of the like amount for every reduction of 1d. below 2s. 10d. in the whole of a half year. The Bill contains provisions for the sale of the unissued stock, and a scheme for the representation of employees in the management of the Company. Clause 9 provides that the District Council of Beckenham are, once a year, to cause to be laid before them the accounts of their electric light undertaking; and they are thereupon to fix the charges to be made for the supply of energy in the ensuing year at such rates, within the maximum, that the revenue for the year shall not be less than the expenditure.

South Shields Gas Bill.

By this Bill, the South Shields Gas Company seek to obtain further powers. It is proposed, first to construct a retaining wall and embankment and a jetty or landing-stage on the south shore of the Tyne; also a railway siding from the South Shields branch of the North-Eastern Railway to the Company's works, to be completed within five years. Authority will be sought to construct works for the manufacture of ordinary or "power" gas and the conversion of residual products on lands in the parish of Harlon described in a schedule. Additional capital, to the amount, inclusive of premiums, of £300,000, to be sold by auction or tender, will be required. Unsold stock may be offered at the reserve price to the shareholders, the employees, or the consumers. Borrowing powers to the extent of one-third on the existing and the additional capital will be applied for. The standard rate of dividend is to be 5 per cent., with an increase or decrease of 2s. 6d. per cent. for each 1d. by which the standard price fixed by the Company's Act of 1879 is reduced or increased in any half year. A reserve fund is to be formed. Clause 43 authorizes the Company to manufacture and supply "power" gas; but it is not to contain more than 14 per cent. of carbon monoxide, and it must possess a "distinctive and readily perceptible smell." The penalty for non-compliance with these conditions is not to exceed £50. Among the miscellaneous provisions, which relate to the supply of fittings, &c., there are some bearing upon the quality and testing of the gas. After Jan. 1, 1905, the illuminating power is to be 14 candles, tested by Sugg's "London" argand burner, or such other as the Board of Trade may prescribe. The boundary between the limits of supply of the Company and of the Newcastle and Gateshead Gas Company is to be altered in accordance with a schedule to the Bill.

Tynemouth Gas Bill.

As in the preceding case, this Bill is to confer further powers. It is proposed to extend the limits of supply of the Tynemouth Gas Company so as to include the civil parish of Earsdon, in the county of Northumberland, which is adjacent to the Company's limits, and is at present without a supply of gas. Additional capital not exceeding £150,000, bearing 5 per cent. dividend, will be applied for. The new stock is to be sold by auction or tender, in lots of not more than £100 nominal value—unsold stock to be offered at the reserve price Borrowing power to the extent of one third will be asked for in respect of the new capital. Authority will be sought to construct works on lands adjoining the existing works, and to purchase other lands by agreement. The maximum price to be charged in the area proposed to be included within the Company's district is 3s. 10d. per 1000 cubic feet, subject, however, to reductions as the total quantity of gas consumed is increased. From the 30th of September next, the illuminating power of the gas is to be lowered from 16 to 14 candles; and the Company undertake to supply to ordinary consumers when required after that date, and to slot-meter consumers as soon as reasonably practicable, burners suitable for the gas of the lower illuminating power. Clause 34 contains a number of provisions as to the construction and placing of pipes, &c., between the mains and the consumers' meters; and the remaining clauses relate to fittings, stoves, engines, &c.

QUALITY OF GAS AT EDINBURGH.

At last Tuesday's meeting of the Edinburgh Town Council, Mr. Macpherson asked if the Lord Provost (Sir Robert Cranston) had any remarks to offer with regard to a motion made at a former meeting as to the quality of the gas. The Lord Provost replied that, owing to the postponement of the meeting of the Gas Commissioners, nothing had been done; but he had received the following from Mr. Herring:—

As we have not had a meeting of the Gas Commissioners since the quality of the gas was last discussed by the Town Council, I venture to address you on the subject. I am conscious of murmurings about town as to "bad gas." In some cases, I am aware that this arises from a deficient supply in the district mains, and is to be remedied by the extension of the trunk main, which was partly laid during the present year. In many cases, the defects and deficiencies rest entirely in the consumers' own houses; and we are always glad to receive a note of such complaints and put them right free of charge. During November last, we received in all 612 complaints, or at the rate of seven per thousand consumers. With the exception of forty-three of this number, the complaints were remedied by attending to some or other of the fittings within the houses. Up to Dec. 15, we have received 357 complaints, or four per thousand consumers; and with the exception of thirty, the defects and deficiencies were remedied by attending to the meters, the fittings, or the piping in the consumers' houses. The general complaining, however, cannot be accounted for by either of the foregoing causes. On the other hand, our scientific instruments at Granton tell us that the illuminating power of the gas is fully up to the standard, and ranges from 24 to 26 candles. This also is verified by the tests of the City Analyst, who appears on the scene from time to time. By testing the gas at our New Street works, we also know that the gas manufactured at Granton carries its illuminating properties better than did the gas formerly made at the old works.

Upon thinking the matter over carefully, and reviewing it from all points, I can come to no other conclusion than that the general complaint arises from the fact that the standard of comparison has changed. The lighting of the streets with the arc electric lamps, the flood of light which is now indulged in in shop-lighting as compared with what it used to be, but more particularly the general adoption of the incandescent gas-burner, with its intensely white light, naturally makes the old-fashioned gas-flame look poor and meagre by comparison. It is not, however, that the light given by this flame has decreased, but the great increase of light obtained by the incandescent gas-burner makes it appear so. Even some of the electrically-lighted shops look dull by comparison with a shop lighted by incandescent gas near by. Seeing that the incandescent gas-light yields six times more light with the same consumption of gas than the flat-flame burner, the inference I have made is, I think, a reasonable and fair one; and I humbly submit it for your consideration.

Mr. Macpherson said he was not satisfied with the answer; but the Lord Provost intimated that there could be no discussion of the matter on that occasion.

It was subsequently reported that the analysis of the gas supplied to the city on the 2nd inst. gave an illuminating power of 25 standard candles; while on the 19th the result was 25·9 candles.

At a later stage, Treasurer Brown and Mr. Macpherson gave notice of the following motion: "That it be remitted to the Cleaning and Lighting Committee to report upon the present arrangement for testing the quality of the gas supply in the city, and what alterations (if any) should be made thereon; with power to report the results of additional tests."

A TEMPORARY ACCIDENT AT WELLINGBOROUGH MAGNIFIED.

In the morning papers on Christmas Day, there appeared an exaggerated account of an unfortunate, but easily remedied, interruption of the gas supply at Wellingborough—the accident being attributed to "a trial of the new works." The facts of the matter are these: Gas making started at the new works on Dec. 17; and no hitch of any kind occurred so far as the supply of gas was concerned. Last Wednesday, several beds of retorts were shut off at the old works. But unfortunately on Thursday afternoon, the Engineer (Mr. J. T. Lewis) discovered that the gas was being rapidly reduced in quality; and he traced the cause of this to one of the hydraulic mains, the tar and liquor valve of which had leaked, and let the water out of the main, which, of course, allowed air to be drawn into the gas. Good quality gas was soon sent out from another holder; and the whole thing was remedied before darkness set in. No doubt, some of the consumers were inconvenienced up to five or six o'clock by the gas they were using not being up to the standard illuminating power; but there was nothing whatever to justify the attempt at making something sensational out of the affair as was done in last Friday's papers. At the same time, the inconvenience, such as it was, is greatly regretted.

MUNICIPAL LEGISLATION IN SOUTH AUSTRALIA.

Evidence has just reached us that recent legislation in England affecting municipal corporations has not been overlooked at the Antipodes. We learn from Adelaide that both Houses of Parliament have lately passed an Act to amend the Municipal Corporations Act, one clause of which (the 25th) requires every local authority owning a revenue-producing undertaking to publish a balance-sheet in reference thereto. The clause runs as follows, and it will be seen that it is very much on the lines of a certain clause with which readers of the "JOURNAL" are familiar.

Any corporation or local authority which shall construct or purchase any tramways undertaking, gas-works or electric light works, or other services, shall, once in every year after the first year's working of such tramways undertaking, gas-works or electric light works, or other services, cause to be laid before it, and published in one daily newspaper circulating in the municipality, a statement of and balance-sheet of the accounts of such tramways undertaking, gas-works or electric light works, or other services, and of the working thereof during the year then last past, drawn up in such form as to distinguish capital from income, and to show the original cost of the construction or purchase of such tramways undertaking, gas-works or electric light works, or other services, and the receipts and expenditure of such year; and the local authority shall thereupon fix annually a schedule of fares and the charges to be made in connection with such tramways undertaking, or for the supply of gas or electric light (not exceeding the maximum rates, if any, specified in the Gas and Electric Lighting Act, 1891), or other services, in the then ensuing year at such rates so that, so far as is reasonably practicable, the revenue of that year shall not be less than the expenditure of that year.

A complete installation of the Keith intensified incandescent gas lighting system has been fitted in the new workshops of Messrs. Ransomes, Sims, and Jefferies, Limited, of Ipswich. It consists of 161 reflector fittings of 300-candle power each, 28 reflector fittings of 150-candle power each, and three lanterns in the yard of 1000-candle power each. These give a total candle power of 55,500, for a consumption of 1700 cubic feet of gas per hour, or 32 candles per foot of gas. In a workshop at the rear of the gas offices, six 300-candle power and six 150-candle power lights have also been fitted up.

DUNDEE CORPORATION GAS-WORKS.

Proposed Further Extensions.

Mr. A. Yuill, the Engineer and Manager of the Dundee Corporation Gas-Works, has prepared a report on the alterations and additions he considers necessary. He states that he feels it his duty to report as to the present position as well as the future requirements of the works, with the view of having them placed on a satisfactory footing to meet any demands.

The arrangements made some time ago for dealing with such materials as coal, lime, coke, and the railway facilities then carried out, are working satisfactorily; and these have the tendency to reduce the cost of handling. The new retort-house and coal-stores are very commodious, and are fitted up with all the latest appliances for minimizing labour and the cost of handling materials. This has shown itself from the lessened cost of working compared with the former method. The coal-stores are capable of accommodating sufficient material for five weeks' requirements of the maximum demand. The coal breakers and elevating machinery work satisfactorily; but he considers it would be an advantage to introduce hydraulic elevators for emptying the waggons. For the four hoppers, eight hydraulic rams would be required, which would be actuated by the hydraulic accumulators at present existing. The hydraulic lifting rams could be installed for (say) £450. With these, two men would be able to deal with all coal requirements, amounting to above 70,000 tons per annum. At the present time, they pay 1½d. per ton for the emptying of waggons, or approximately over £440 per annum. The retort-bench comprises 574 retorts in all. There will be available space in No. 2 retort-house, when erected, for 638 or 696 additional retorts. Taking the latter number, it would give about 120 per cent. more than at present; and 25 per cent. is considered a safe margin to have against contingencies. There are 240 retorts in the old retort-house, which could be partly utilized during an emergency; but he would not advise or recommend their use permanently, as there are no facilities for depositing or storing coal. Besides, all the retorts would require to be worked by manual labour, which would be more expensive compared with the present system. Before the old retort-house could be utilized to any advantage—which would only be for a few years—considerable expenditure would require to be incurred in the heightening of the retort-house walls and roof, and other structural alterations, to allow of any form of stoking machinery to be profitably installed. Should the Town Council agree to the erection of No. 2 retort-house, he would not advise this to be done in its entirety meantime, as it would necessitate the removal of two gas-holders, having a storage capacity of 900,000 cubic feet; but 264 retorts could be erected without interfering with the two holders. This he estimates would cost approximately £18,000.

The condensers are capable of dealing with over 5 million cubic feet of gas per 24 hours, which is ample for some time to come. The new engine and exhausters are now in use, and working satisfactorily. They are capable of dealing with 300,000 cubic feet of gas per hour. No alteration or addition will be required on the exhausting plant for many years. The two new scrubbers and washers are giving every satisfaction, and are capable of passing the quantity of gas stipulated for—viz., 5 million cubic feet per 24 hours. There are five sets of purifiers—three sets of 1,000,000 cubic feet capacity, and two sets of 750,000 cubic feet per 24 hours. One of the latter sets is in such a state as to be unsafe to use. This reduces the purifying capacity to 3¾ million cubic feet, which may be taken as equal to present requirements without allowing any margin for safety or for the future. When the gasholder accommodation is considered, it will be seen that it is inadequate; and before a new holder is put down, one of the million cubic feet sets of purifiers will require to be removed to make room for it. This will reduce the available purifiers to 2¾ million cubic feet per 24 hours, which is inadequate.

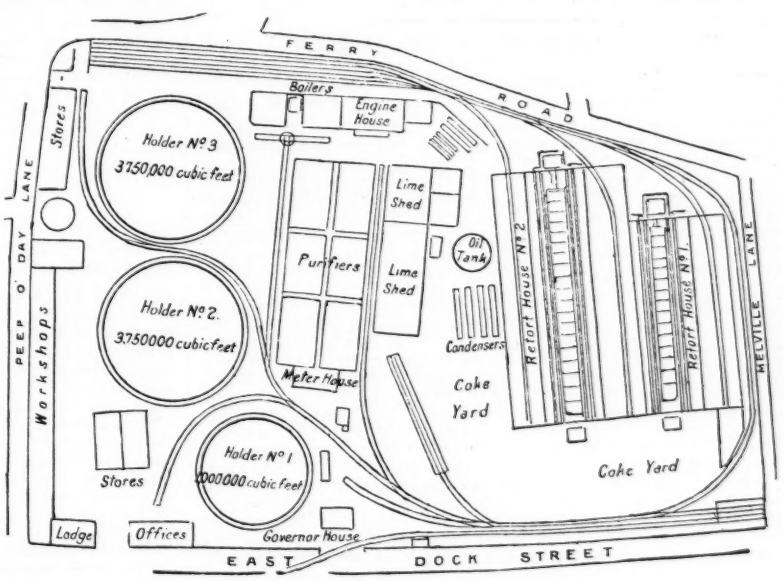
The work in the chemical department is now confined to the manufacture of sulphate of ammonia from the ammoniacal liquor. New condensers are being put up to deal with the hot gases from the saturator. A new saturator is also being erected, and will be at work shortly. This is fitted with "Wilton's" patent discharger, whereby the sulphate of ammonia is thrown out of the saturator into buckets moving on an elevated rail, along which it is run to the sulphate store-house. After this work is completed, the plant will be able to deal with 5 tons of sulphate of ammonia per day.

There are five gasholders at the works in use, and one at Lochee for local requirements only, giving a total storage of 2¾ million cubic feet. No. 4 holder is somewhat out of repair, and rather unsafe, owing to the leakage of water from the lute when the top lift is brought into use. No gas-works are safe against contingencies, unless they have at least storage equal to the maximum day's requirements. In Dundee, the storage accommodation is about 69 per cent. of the maximum daily consumption. Should the Council consider it advisable to erect a new holder at the present time, he would recommend one about 200 feet in diameter, in three lifts and 40 feet deep, giving storage for 3¾ million cubic feet. This would cost from £38,000 to £40,000—according to when it was put in hand.

The street-mains have been kept in a good state of repair from time to time, and arrangements have been made whereby the pressures will be taken over the whole city this month, so as to determine local requirements. In considering the prospective needs of the city, it is essential from an engineering point of view that any alterations or additions carried out from time to time must form part of a completed whole, so as to obviate the necessity of demolishing buildings and plant unnecessarily. With this object in view, he has drawn plans of the gas-works as they exist at present, together with a prospective plan of works capable of producing and dealing with from 9 to 10 million cubic feet of gas per 24 hours. From the latter plan, it will be observed (see below) that the buildings and plant are so arranged that additions may be made as required. This allows for an annual consumption equal to about two-and-a-half times more than the present requirements.

The points demanding consideration are: Gasholder accommodation, more producing power, and an alteration of purifying arrangement in the event of a new holder being erected. Before dealing with the holder accommodation, he prefers considering the question of producing power; and in doing so, he feels it his duty to place before the Corporation the relative advantages of coal gas as produced by the ordinary methods and the production of carburetted water gas. Should they agree to the adoption of the latter method, it would obviate the necessity for the erection of a holder for some time to come. The manufacturing charges for coal gas per 1000 cubic feet are 1s. 2·65d., and for water gas 1s. 2·161d. The net cost of the new works, if coal gas were adopted, would be 1s. 4·05d. per 1000 cubic feet, and for water gas 1s. 3·20d. In connection with coal gas, the new holder would cost (say) £39,000, and the new retort-house, &c., £18,000—or a total expenditure of £57,000.

On the other hand, carburetted water-gas plant would cost £6000. In estimating the cost of production of coal gas and carburetted water gas, he has taken the cost of the former from the present actual charges, and in the case of the carburetted water gas, the average cost of working from those who have had practical experience with the plant in question. From the above figures, it will be observed that the cost of production is practically the same in both cases, after debiting each



with the interest and sinking fund chargeable on the capital expenditure necessary. Regarding the question of coal gas *v.* water gas, it has been experienced that the adoption of the latter has conferred collateral advantages to the cost of production of the former, when used as an auxiliary to coal-gas manufacture, which could not otherwise be obtained—such as the control of the coke market by providing a demand on the works, the immediate availability of the plant during periods of excessive demand, or in the case of a partial stoppage of the coal-gas plant through defects in machinery, &c., and the prevention of naphthalene deposits in the street-mains and consumers' fittings, owing to the carburetted water gas acting as a solvent vehicle for naphthalene, which tends to prevent its precipitation from the coal gas. He recommends the adoption of a carburetted water-gas plant capable of producing 750,000 cubic feet per 24 hours, at the approximate price previously noted, which would suffice for their requirements for some time to come, and would keep them safe against contingencies. A new gasholder, if arranged for at present, could not be brought into service earlier than the year 1906, as before the ground was available for it a set of purifiers would require to be removed, and before these were dispensed with the first set of new purifiers would require to be erected. The cost of these, together with the necessary piping, would be approximately £8000.

The introduction of gas heating and cooking apparatus, together with the developments that are taking place in the utilization of gas for motive power, are all factors that may be considered and encouraged. With the view of showing their position as compared with other towns as regards the introduction of cooking-stoves, Mr. Yuill has prepared a list of towns showing their make of gas, number of consumers, and the stoves fixed. In Dundee, it appears from the figures that there are 826 stoves; and the average number of consumers per stove is 56·08. Broughty Ferry has 1460 stoves, with 2·35 consumers per stove; Arbroath, 570 stoves, with 10·47 consumers per stove; Perth, 3048 stoves, with 2·88 consumers per stove; Aberdeen, 1880 stoves, with 20 consumers per stove; Glasgow, 22,605 stoves, with 9·29 consumers per stove; and Edinburgh, 6051 stoves, with 13·56 consumers per stove.

DISPLACING THE ELECTRIC LIGHT BY HIGH-POWER GAS-LIGHTS.

High-power incandescent gas-lamps are displacing the electric arc lamps that were erected on the electric trolley poles at Alloa. Reference was made to the change at the last meeting of the Town Council. Dean of Guild Watson regretted that the Lighting Committee had not seen their way to cut off the whole of the eight arc lamps as had been agreed. Four had been removed; and, in their place, three Scott-Snell lamps and one of another make had been put up. The last-named had not been found to be wind-proof; but the manufacturers had promised to make it so. The Scott-Snell lamps had proved very satisfactory so far; and now he had not the slightest fear that these lamps were quite fit to take the place of the arc lamps, and give equal light. If the Council still wished to further reduce the electricity bill, they had only to say so, and the Committee would willingly strike off more of the arc lamps. He recommended that the whole of the superintendence of the burgh lamps should be left to Mr. Napier, the Gas Manager. The Provost said that of the excellence of the new high-power gas-lamps, he for one had not the least doubt. It was a pity they had to cut off the electric light; but in their present position, they were compelled to reduce the account. Bailie Crawford inquired if there had been such a wind since the Scott-Snell lamps were put up, as caused the accident to the other make of lamp. Dean of Guild Watson replied in the negative. The question was ultimately left to the Committee to deal with further.

[The gale was not long in coming, for on Monday night of last week there was a storm all over Scotland; and a correspondent was informed that "the Scott-Snell lamps were standing out well, and causing no trouble whatever." It may be mentioned here that the Company owning this system of lighting, have received an order to supply a further twelve lamps to the Chelsea Borough Council, which will make a total installation of thirty lamps.]

BRISTOL ELECTRICITY WORKS IN FLAMES.

What might almost be termed a disaster fell upon the shopkeepers at Bristol last Wednesday evening, when, at about 5.30, the electric light throughout the city was suddenly extinguished. People had come in crowds to see the shops and make their Christmas purchases, only to find a city plunged in fog and darkness. It is stated that, on the light going out, there was a rush, amounting almost to panic, for substitutes. Stocks of candles were rapidly disposed of; and bicycle and carriage lamps, and even nightlights, were requisitioned. It is sad to learn that only in a few instances were there gas-fittings in reserve, though it is added that "in the big houses many had gas-connections, and at once rigged up old-fashioned jets, some of which were thickly coated with rust, showing that they had been cast aside long since." The cause of all this trouble was a fire at the central power station of the Corporation, which rendered the shutting down of the works imperative. The machinery was at the time working under great pressure; and the accident was caused by the fusing of the wires of a switchboard. The fire spread so rapidly that soon the whole length of the building was in flames; and the damage caused was, of course, very extensive. Seeing the state of affairs, the Tramway Company offered a supply of current from their power station; but in the meantime the Corporation officials had taken steps to establish a connection with their own auxiliary station some distance away. This could not, however, be completed in time for the supply of electricity to be resumed the same night. On Thursday morning, a notice appeared in the papers, signed by the Town Clerk, to the effect that electricity for lighting and power purposes would be supplied as usual; but this announcement proved to be somewhat premature, as until about half-past eight at night those who were not provided with gas had again to fall back upon candles and lamps. Naturally, this caused much disappointment to those shopkeepers who had suffered so severely the previous evening. It may be pointed out that, though the two generating stations are over a mile apart, for some reason or other, the cables from the works at Avon Bank are brought into the Temple Bank works. Thus it was that the fire at the latter disconnected the supplying cables from both works.

WORKPEOPLE ENGAGED IN ELECTRICITY SUPPLY.

In connection with the figures published in the "JOURNAL" for the 15th inst. showing the number of gas workers in the United Kingdom, we give below, as a means of comparison, as far as possible, those relating to workpeople engaged in electricity supply. As in the case of the gas workers, they are extracted from the 1901 census returns.

England and Wales	2915 (including 27 females)
Scotland	504
	3419

In addition to these, there were 49,518 persons (including 2490 females) enumerated as electrical apparatus makers; the totals for Scotland and Ireland respectively being 4190 and 899.

Ranged under the usual age groups, the distribution for England and Scotland is as follows:—

	20	25	35	45	55	65
England and Wales .	521 ..	1013 ..	655 ..	252 ..	72 ..	15
Scotland	92 ..	200 ..	92 ..	42 ..	15 ..	7
	613	1213	747	294	87	22

In England and Wales, there were 385 persons (18 being females), and in Scotland 56 persons, between the ages of ten and twenty; and 2 in England and Wales of 75 years and upwards. It may be of interest to add that of the total number of electricity supply workers, 1123 were enumerated in London.

FLINT PUBLIC LIGHTING.

The Committee who considered the matter having recommended, at the last meeting of the Flint Town Council, the acceptance of the Gas Company's tender, to undertake the public lighting as usual for a sum of £266 12s., Mr. E. A. Hughes moved, as an amendment, that the Council offer the Company 4s. per 1000 cubic feet for the gas, and do the lighting, cleaning, and extinguishing themselves. The Town Clerk read statements of the Councils of Mold, Connah's Quay, Holywell, Denbigh, and Ruthin, as to their different schemes of lighting and the cost. From these, it appeared that Denbigh paid 4s. 4d. per 1000 cubic feet, and did their own lighting and cleaning. Connah's Quay paid 24s. per lamp, and did their own lighting and cleaning. Ruthin paid 4s. 6d. per 1000 cubic feet, and 8s. 4d. per lamp for lighting and cleaning. Holywell paid 38s. 1cd. per lamp to cover all. The hours of lighting in each place varied considerably. He said that Flint paid 4s. per 1000 cubic feet and 11s. 6d. per lamp for lighting and cleaning. The total consumption of gas for public lighting in Flint was 786,090 cubic feet. Mr. Hughes remarked that, according to a return supplied to him by the Company, the total consumption was 803,000 feet. It was, however, explained that the latter figure would include extras and summer lighting. Mr. Hughes said that taking the higher figure of 803,000 feet, at 4s. per 1000 feet this only amounted to £160 12s. for gas, and therefore left £76 per annum as the cost of lighting, cleaning, and extinguishing. In other words, they were paying for the latter items almost one-half the total amount they paid. He considered this was very excessive; and he was strongly of opinion that the Corporation could do the work very much cheaper. About £40 would be ample to cover this item. Mr. Powell seconded, and said nine out of every ten of the ratepayers were of opinion that there ought to be a reduction in the price paid for public lighting. He suggested that they should obtain the opinion of an expert on the matter. Mr. E. J. Hughes said he was not there to defend the Company, but he very much doubted whether the Corporation could do the work at a cheaper rate than the Company could. If the mover and seconder of the amendment would guarantee that the cleaning and lighting could be done for 8s. 4d. per lamp, the same as at Ruthin, he would support them; but having regard to the conditions attached to the lighting of the Flint lamps, he was of opinion that they could not have it done cheaper than the present rates. On being put to a vote, eight were against the amendment, while only three voted in its favour.

AN EXPLOSION IN A SEWER.

The General Purposes Committee of the Greenwich Borough Council, in a report issued on Tuesday, stated that the Surveyor had fully investigated the circumstances attending an explosion in a barrel sewer in Blackwall Lane and Dreadnought Street. It was ascertained that, owing to a mishap at Ordnance Wharf, belonging to the South Metropolitan Gas Company, a large quantity of naphtha found its way into the drain on the premises, and, as the result of mingling with hot water coming from various factories, generated a highly inflammable gas. The accident having been discovered, the Manager-in-Charge immediately suggested to the Council's men, who had been working in the sewer for some days previously, that they should not take a light into the portion in Dreadnought Street, nor into the 3 ft. 6 in. sewer in Blackwall Lane. This was attended to; and the men thought they would test another part where they wanted to work before entering it. The man in charge of the gang, who was standing about 3 feet from the side entrance shaft, struck a match, whereupon the air round the mouth of the entrance ignited and an explosion followed. The gas in the sewer was then fired, and, running along against the flow of sewage, caused explosions in every side entrance, gallery, and shaft, as well as in the pockets under the man-hole covers in the centre of the road, blowing them from their bedding. The accident happened at 8.40 a.m.; and fortunately no fatalities resulted. The charge for making the damage good has been debited to the Company.

Damage to Mains by Steam-Rollers.—The Clones Urban District Council have ceased to employ steam-rollers on the streets of the town, owing to the damage done through them to the gas-pipes. They have also settled an action which was pending against them for injuring the Gas Company's mains, and loss and damage sustained thereby. The action was for £120; the sum they have agreed to pay is £60.

Proposed Gas-Works Purchase at Halesowen.—A movement has been initiated at Halesowen, the object of which is to secure an improvement in the facilities for street lighting, and also a cheaper supply of gas, both for public and private consumption. A proposal has been made that the various local bodies should unite and devise a scheme for the purchase of the gas undertaking. It is stated that a conference of representatives from four of the Parish Councils in the district is to be held at an early date.

Position of the Audley Gas-Works.—The Gas Manager to the Audley Urban District Council (Mr. J. Mottram), with a view to correcting some erroneous impressions which have been allowed to get abroad as to the condition of the works, has prepared a report in which he draws attention to the fact that in 1900, before he was appointed, the leakage was 33 per cent., whereas it has now been reduced to 20 per cent. In the former year, the wages bill amounted to £359, on an output of 6,995,000 cubic feet; while last year the make was 9,934,500 cubic feet, and the wages account £376. The latter figure included the labour for all the extensions which were made, and which had not to be met in the earlier year named. The result of the operations in 1900 was an adverse balance of £78; but last year's working left a balance in hand of £396. Mr. Mottram naturally contends that these facts indicate a satisfactory condition of affairs; and we are glad to see the Council agreed with him. The report is to be circulated.

METROPOLITAN WATER ARBITRATION.

(*Before the Right Hon. Sir* EDWARD FRY, *Sir* HUGH OWEN, G.C.B., *and Sir* JOHN WOLFE-BARRY, K.C.B.)

Thirty-First Day—Tuesday, Dec. 15.

At the conclusion of their award in the East London case, reported in our last issue, the Court proceeded to deal with the

West Middlesex Company's Case.

The claim of the Company amounted to £4,200,240; the offer of the Water Board being £1,500,000.

Mr. CRIPPS, in opening, said that the decision which had been already given would relieve him of the questions of purity or quality of the West Middlesex water; but he would show what the storage and filtering capacity were. The Company were entitled to take 24½ million gallons a day from the Thames. The first Act which the Company obtained was in 1806, when they were given power to take water from the Thames not westward of Kew Bridge. There was no limit as regarded the amount. The Company were only called upon to pay £5 5s. a year for the privilege. Proceeding to deal with the subsequent legislation, the learned Counsel said that under the Act of 1899 there was a statutory recognition of the right of the Company to draw in one day 24½ million gallons. For any further supply they might require, they would have to go to the Staines reservoirs. The Company had finished paying their back-dividends as long ago as 1887; and at the time of the passing of the Act of 1896, they were not only paying their maximum 10 per cent. dividend, which took £115,000, but were paying something like £30,000 a year to their consumers by way of rebate. The effect of the clause in the Act of 1847 was that, when the revenue had reached a certain height, instead of a particular Company being entitled to the full benefit, they had to bring the existing consumers into partnership. Mr. Moulton's contention appeared to be, in regard to the present Company, that there would be some claim with reference to the future consumers which could take away the rights of partnership or rebate which had already inured to the existing consumers. This was unarguable upon the true construction of the Water-Works Acts. There was no such principle as appeared to be suggested on the other side—that some outside consumers in some other parts of the district could come and compel the Company to spend their existing revenue, and so interfere with the interests which the existing consumers had already got. Therefore, he apprehended that, when the Act of 1896 was passed, they were in the position of a Company who had not only paid all their back-dividends, and were paying the maximum dividend of 10 per cent., but they had a very large margin in hand. The Act of 1896 could give no advantage to the Company. The effect of the sterilization clause had been to weaken the Company's statutory position.

The PRESIDENT asked if Mr. Cripps's contention was that the Company were so strong in 1896 that their strength was not substantially increased by the passing of the Staines Reservoirs Act.

Mr. CRIPPS said that the Act was in fact a great disadvantage. It had been held that as soon as the water was in the Staines reservoirs for the purposes of the Joint Committee, then the charges in respect of them had to be taken into consideration. If the Company brought in these charges, the £149,252, which was the net income in 1901, would be £136,550. This still left a large margin above the 10 per cent. maximum dividend, which only required £115,000. In two years only would they be slightly under this amount. Against the deficit in these two years, the Company had a reserve fund of £70,000, which they were entitled to use in any year that they did not reach the 10 per cent. Therefore, the Company had their maximum income well secured; and the question for the Court was reduced to the simple one of what should be the multiplier of this maximum income. The exact amount required was £115,506 12s.; and he submitted that the highest multiplier should be applied—viz., 36·36. This brought the total to £4,200,240. The share capital was £1,155,066. The 10 per cent, £115,506, was an ascertained figure which could not be attacked. They added 1 per cent. for allowances for cost of reinvestment and so on (£42,002), and another 1 per cent. for recoupment of loss of interest pending reinvestment. Certain other allowances were claimed, the figures for which would be given in evidence.

Mr. MOULTON submitted, as a point of law, that the Company were only entitled to draw 20 million gallons per day from the Thames, instead of 24½ millions, except in so far as they used Staines. This was a question of construction of the Act. He argued the matter at great length, and pointed out that section 8 of the Act of 1866 expressly limited the Company to this amount, and that no Act up to that of 1899 could be suggested to alter that legislation. As to the Act of 1899, he submitted that, on the true construction, it could not be said to affect the matter.

Mr. CRIPPS, in reply, said there was power to take water without limitation by the old Company as constituted in 1806. The first limitation was an agreed limitation of June 23, 1862. On the legal principle, one could not, by mere agreement, limit an unlimited right which a statute had given, and which might be used for the public. Therefore, the limitation would not have overridden an unlimited statutory right. He contended that all that section 8 of the Act of 1866 did was to put the agreement into statutory form between the parties, so as to be binding in the sense that it really became a statute of limitation upon a former unlimited statutory right. But the Act of 1899 clearly showed that the Company had a right to 24½ million gallons per day; and no one had ever questioned that right until the Water Board came on the scene.

Mr. HALDANE followed on the same side, contending that section 21 of the 1899 Act was an enacting provision, and made it plain that the status of the Company was that they could take 24½ million gallons.

Thirty-Second Day—Thursday, Dec. 17.

Mr. HALDANE resumed his speech this morning. The Company, he said, had entered into an agreement with the Thames Conservators, whereby they had to pay a price if they took 24½ million gallons per day from the Thames. Therefore, it was clear that they had a right to take this quantity if they needed it.

Mr. MOULTON, in reply, said that the clause of the Act of 1866 was absolutely clear; it was prohibitory of the Company taking at any time more than 20 million gallons. There had been a perpetual attempt on the part of the City Corporation—subsequently the Conservators of the River Thames—to treat the river as though it belonged to them, and to use it for their profit. Their interest was only the interest of persons whose duty it was to preserve the navigation; and they had no right at all to purchase or sell. The next step in the matter was the Act of 1886. But it could not be said, after clause 8 of the Act, that an agreement between them and the Conservators entitled them to violate this section.

The PRESIDENT said the question was as to whether the agreement made on Dec. 23, 1886, between the Conservators of the River Thames and the Company, was a valid one. This agreement had, shortly, two effects. In the first place, it cast upon the Company the obligation to pay to the Conservators £1000 a year in addition to the sum which they were already liable to pay. In the second place, it gave the Company the right to take 24½ million gallons of water from the Thames every day. By section 8 of the 1866 Act, it was enacted that the Company should not at any time take from the River Thames any water in excess of 20 million gallons a day. But there was the question of whether a public right had been subsequently constituted. In order to do this, they had to consider three enactments. The first was the Thames Conservancy Act of 1894. Without going into details with regard to this, it provided that a sum of money should be paid to the Conservators. This appeared to him to be a recognition of the liability of the Company which was created by the Act of 1866. The next Act, that of 1899, appeared to be much more important. The agreement was between the Conservators and the Company. It was quite true that the Act was treated as a Private Act; but it was impossible not to observe that the bodies were not representative of private interests alone. The Conservators had public duties to perform. On the other hand, the Company was a body which was performing a public duty in respect of which the Legislature would be interested, not merely with respect to the dividends to be received by the shareholders, but with regard to the supply to the public. Section 21 appeared to them plainly to recognize the right of the Company to take 24½ million gallons, and provided for temporary powers in excess of this. The effect of it, in the judgment of the Court, was recognizing the permanent right of the Company to take 24½ millions—it was a recognition of the right under the agreement. This was their view of the case; but it might very possibly turn out that the affirmation or negation of Mr. Moulton's proposition would make no difference in the award.

Mr. *J. G. Fowler* gave evidence as to the Company's financial status. The net water-rental in 1903 was £305,098; working expenses, £119,692; gross profits, £185,406; and net income, £152,710. The gross profit in 1923 was estimated at £271,285. The authorized capital in 1903 was £1,155,066; debenture stock, £890,000; a total of £2,045,066. Of this, £1,905,066 had been issued; and the borrowing powers at the close of 1903 were £136,408. The amount of water supplied in that year was 8,137,728,794 gallons; the gross rental was £312,067; and the working expenses were £96,478. The expenses on the Staines reservoirs up to the end of March last were £12,504.

Mr. *H. E. F. Rutter*, the Engineer to the Company, said the works were in good order in every respect, and there had not been the slightest necessity to economize. They had ample filter-beds and storage. With regard to the rate of increase of the supply in the Metropolis, from 1891 to 1901 it was only 3·1 per cent.; but when they went outside to the districts of Acton, Willesden, &c., they got a much larger percentage. These were the districts which were now rapidly filling up. At the present time, they had £160,000 of capital in hand. This would supply the needs of the Company, in his view, up to the year 1910. The rental received showed a steady increase; and there was good reason to assume that the increase would continue in the future. The available reservoir capacity was 358,900,000 gallons. Therefore, in addition to having the power of taking 24½ million gallons a day, they had storage capacity for 350 millions. They could go on up to 1908 before they drew from the Staines reservoirs.

Mr. *Charles Hawksley* said the Company's works were in excellent order. There was a sufficient margin of filtration area. He generally agreed with the figures that had been put before the Court as to the capacity of the supply.

By Mr. MOULTON: It would only be in periods of extreme drought that the water would be drawn down. It would be near the bottom in a very short time.

Mr. *R. E. Middleton* gave similar evidence.

Professor *Dewar* spoke as to the quality of the water, and said that it was admirable as a rule.

The PRESIDENT said the Court would like to have some intimation as to the prices of the shares.

Mr. *F. H. Wybroo*, the Secretary of the Company, said he had collected evidence as to the rates at which the stock had changed hands in recent years. The highest figure was 332, in 1896. The lowest figure was 240, in 1893; but since that date, the lowest price was in 1901, when it was 261¼. The Company had always paid a dividend of 10 per cent.

Mr. CRIPPS then put in the formal claim of the Company, and called a witness as to the last item—that of ½ per cent. for expenses.

Mr. *W. E. Gillett*, the Solicitor to the Company, referred to the extra work caused by the passing of the Act to the Directors and staff.

Hon. J. D. FITZGERALD cross-examined as to details; but witness said it was difficult to form accurate estimates of the cost. He never knew an estimate of a bill of costs that had not been exceeded.

Thirty-Third Day—Saturday, Dec. 19.

Mr. *James Mansergh*, in answer to Mr. CRIPPS, said he had been over all the works and plant of the Company, and had found it in very good order. They had sufficient storage for the maximum demand.

Mr. MOULTON then addressed the Court on behalf of the Water Board. He said that the West Middlesex case was very different from

that of any previous Company. His learned friend fully recognized this difference. The Company for years had paid maximum dividends; had paid all back-dividends: and had given a rebate to their customers for many years—originally of 10 per cent., and now 5 per cent., of the maximum authorized charges. There could be no doubt that a Company of this kind, so far as its income was concerned, had a much stronger case than the Companies whose cases had previously been considered. With the exception of the point of the date at which they must be held to take over the Staines reservoirs, there was very little difference between the two sides. Mr. Cripps did not admit 1904 or 1905; but he contemplated that possibility. He (Mr. Moulton) had tried to settle the question by raising the point with regard to the Company's statutory supply; and although he had been unsuccessful, he did not think it affected his position, because it was evident that in the immediate future—at the latest, 1905—the Company would have to go to Staines. With the probability of using Staines, the figures would still show the Company would be able to pay maximum dividends for many years. He would go further, and assume that, in addition to paying maximum dividends, there would be a balance enabling them to make a rebate to the public, though this was perhaps rather too rosy a view. He was not anxious to complicate his case at present with a discussion as to how safe the dividend was from the point of view of revenue, and would take it that the revenue was such as to establish before the Court that the dividend would be regularly paid. But he asked the Court to consider how the income was affected by reason of the powers conferred by the sterilization clause. The Company illustrated the position which the London Water Companies had been approaching ever since 1852. In 1880, the question of what should be done with these Companies came up, and assumed an acute stage. At the time, most of them had only limited powers to draw water; and the powers, owing to the increase of the population, were rapidly growing inadequate. In 1896, the first real attempt at providing purely storage reservoirs was made; and at that time the West Middlesex Company had, or claimed to have, the right to take 24½ million gallons a day from the Thames. This was their sole supply. The Company then, with the Grand Junction and the New River Companies, went to Parliament and asked leave to construct storage reservoirs which would give them an average of nearly 12 million gallons a day from the flood waters of the Thames. Parliament granted the Staines Reservoirs Act with the well-known sterilization clause, the effect of which depended very largely upon the facts with regard to the Company to which it applied. This was a Company who were practically at the end of their resources in 1896; and in order to remedy this, powers were obtained to go to Staines. The Company had the advantage of a large area in 1896; but they had increased responsibilities—a splendid income, but no stability. Within eight or ten years, it was certain the demand for water would be greater than the supply; and they had to find new sources. Otherwise their income would only last a few years. The advantage they obtained from the Staines reservoirs scheme was that they were able to perform their statutory obligations from and after the year 1908. Everything in the Company's tables beyond that year was based on the advantage conferred upon them by the Staines Reservoirs Act. Therefore, instead of estimating a few years' fixed income, and a sum for the value of the Company beyond that, they put forward a number of years beyond 1908 as justifying a claim to the capitalization of a fixed income. The whole of this therefore depended on the powers granted by the sterilization clause; so that the Court had to separate from the estimate of value those things which depended upon stability. The value must be assessed as if the Act of 1899, giving the Company additional powers of supply, had not been passed, and as though the stability of the income could not be maintained after 1908.

Sir *Alexander Binnie* was called as the first witness for the Water Board. He presented a table showing the average daily supply drawn by the Company from the Thames during the months from January to October, 1903. The average was 23·03 million gallons; while the average rate per head was 34·51 gallons. A further table showed the average daily supply from 1893 to 1902 inclusive. The average for the whole period was 20,795,000 gallons daily. The average in the month of maximum demand amounted to 23,687,000 gallons; the smallest (1893) being 20,340,000 gallons, and the highest (1901) 25,981,000 gallons. The average rate per head for the period was 34·14 gallons.

In cross-examination, witness said that the Company could probably go on under present conditions till 1905 without having recourse to the Staines reservoirs. The water of the Thames was so dirty now that it required considerable subsidence and filtration.

Mr. *H. E. Haward* put in a number of tables. The first one gave approximate estimates of future income and trading profits, and of charges for interest, sinking fund, &c.; no account being taken of the effect of the sterilization sections in the Staines Reservoirs Acts. The net water-rental, inclusive of rebates (assumed to increase £7500 per annum after March 31, 1903), was estimated to be: (1904) £312,758, (1905) £320,258, (1906) £327,758, (1907) £335,258, (1908) £342,758, (1909) £350,258, and (1910) £357,758. Less rebates, and less working expenses at 42 per cent. of the net water-rental, inclusive of rebates, the profit on trading was estimated to be: (1904) £165,762, (1905) £169,737, (1906) £173,712, (1907) £177,687, (1908) £181,662, (1909) £185,637, and (1910) £189,612. With deductions for interest charges and the Staines reservoirs expenses, and with additions for rents and dividends on investments of the reserve fund, the total net profits, before deducting the sinking fund, were estimated to be: (1904) £129,312, (1905) £119,604, (1906) £122,428, (1907) £125,816, (1908) £128,315, (1909) £131,082, and (1910) £134,244. The balances, after making deductions for sinking fund, were: (1904) £116,125, (1905) £84,410, (1906) £87,000, (1907) £88,495, (1908) £91,590, (1909) £94,090, and (1910) £96,687. These figures showed that further amounts would be required to pay the 10 per cent. dividend—viz., £115,507—as follows: 1905, £31,097 (the deficiency to be provided by £16,013 cessation of rebate, and £15,084 withdrawn from the reserve fund); 1906, £28,507 (£16,338 and £12,119; 1907, £27,012 (£16,763

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 813.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 15	10½	Alliance & Dublin 10 p.c.	18½—19½	..	5 7 8
100,000	10	,,	7½	Do. 7 p.c.	12½—13½	..	5 11 1
200,000	5	Nov. 12	6½	Bombay, Ltd.	5½—6	..	5 8 4
140,000	5	,,	6½	Do. New, £4 paid	4—4½	..	5 15 7
380,000	Stk.	Aug. 13	12	Brentford Consolidated	228—233	..	5 3 0
300,000	,,	,,	9	Do. New	171—176	..	5 2 3
50,000	,,	,,	5	Do. 5 p.c. Pref.	150—135	..	3 14 1
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	103—108*	..	3 14 1
220,000	Stk.	Sept. 11	10	Brighton & Hove Orig.	207—212	..	5 1 5
246,320	,,	,,	7	Do. A. Ord. Stk.	145—150	..	5 3 4
460,000	20	Oct. 15	10	British	38½—39½	..	5 1 3
100,000	Stk.	Aug. 13	6	Bromley, Ord. 5 p.c.	115—120	..	5 0 0
165,700	,,	,,	4½	Do. do. 3½ p.c.	88—93	..	4 16 9
500,000	10	Oct. 15	7	Buenos Ayres (New) Ltd	10¼—10⅝	..	6 10 3
250,000	Stk.	June 26	4	Do 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 10	8½	Cagliari, Ltd.	22—24	..	6 17 6
100,000	10	June 11	10	Cape Town & Dis., Ltd.	14—15	..	6 13 4
50,000	50	Nov. 3	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
1,375,000	Stk.	Aug. 27	5 5/10	Commercial 4 p.c. Stk.	104—107	..	4 17 3
563,750	,,	,,	5	Do. 3½ p.c. do.	97—100	..	5 0 0
442,947	,,	Dec. 11	3	Do. 3 p.c. Deb. do.	84—87*	−2	3 9 0
800,000	Stk.	June 11	7	Continental Union, Ltd.	118—123	..	5 13 10
200,000	,,	,,	7	Do. 7 p.c. Pref.	130—135	..	5 3 8
575,000	Stk.	Aug. 27	5½	Crystal Palace Ord. 5 p.c.	110—115	−2	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	118—123	..	4 1 4
112,533	,,	July 10	5	Do. 5 p.c. Deb. Stk.	135—138	..	3 12 6
486,090	10	July 29	10½	European, Ltd.	18½—19½	..	5 7 8
354,060	10	,,	10½	Do. £7 10s. paid	13—14	..	5 12 6
15,243,200	Stk.	Aug. 13	4 1/10	Gas-light and Coke — 4 p.c. Ord.	87—89	..	4 18 10
2,600,000	,,	,,	3½	Gas-light and Coke — 3½ p.c. max.	86—88	..	3 19 7
3,799,735	,,	,,	4	Gas-light and Coke — 4 p.c. Con. Pref.	107—110	..	3 12 9
4,193,975	,,	Dec. 11	3	Gas-light and Coke — 3 p.c. Con. Deb.	85—87*	..	3 9 0
258,740	Stk.	Sept. 11	5	Hastings & St. L. 3½ p.c.	90—95	..	5 5 3
70,000	10	Oct. 15	11	Hongkong & China, Ltd.	16—17	..	6 9 5
3,800,000	Stk.	Nov. 12	10	Imperial Continental	197—200	−3	5 0 0
473,600	Stk.	Aug. 13	3½	Do. 3½ p.c. Deb. Red.	98—100	..	3 10 0
165,242	Stk.	Aug. 27	6	Lea Bridge Ord. 5 p.c.	113—118	..	5 1 8
561,000	Stk.	,,	10	Liverpool United A	214—216	..	4 12 7
718,100	,,	,,	7	Do. do. B	163—165	..	4 4 10
306,083	,,	June 26	4	Do. do. Deb. Stk.	110—112	..	3 11 5
75,000	5	Dec. 11	5	Malta & Medn., Ltd.	4¼—4⅜*	..	5 5 3
560,000	100	Oct. 1	5	Met. of — 5 p.c. Deb.	101—105	..	4 15 3
250,000	100	,,	4½	Melbourne — 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 12	3½	Monte Video, Ltd.	9—10	..	7 0 0
1,515,892	Stk.	Aug. 13	4½	Newc'tle & G'tesh'd Con.	105—107	..	4 4 1
376,855	Stk.	July 3	3½	Do. 3½ p.c. Deb.	96—97	..	3 12 2
300,000	Stk.	Nov. 26	8	Oriental, Ltd.	135—140	..	5 14 4
600,000	5	Sept. 30	7	Ottoman, Ltd.	5⅞—6⅛	..	5 7 8
					* Ex div.		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
205,005	Stk.	June 26	6½	Ply'mth & St'house 5 p.c	123—128	..	4 15 8
851,070	10	Oct. 15	7	River Plate Ord.	10¾—11¼	..	6 4 5
300,000	Stk.	June 26	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
250,000	10	Sept. 30	8	San Paulo, Ltd.	10½—11½	..	6 19 2
135,000	Stk.	Sept. 11	10	Sheffield A	240—242	..	4 2 8
209,984	,,	,,	10	Do. B	240—242	..	4 2 8
523,498	,,	,,	10	Do. C	239—241	..	4 3 0
116,106	Stk.	Sept. 30	5	Shrewsbury Ord. 5 p.c.	107—112	..	4 9 3
6,150,000	Stk.	Aug. 13	5½	South Met., 4 p.c. Ord.	115—118	−1	4 10 2
1,780,000	,,	July 10	3	Do. 3 p.c. Deb.	86—89	..	3 7 5
380,940	Stk.	Nov. 12	5	Southampton Ord.	105—110	..	4 10 11
87,950	,,	July 10	4	Do. 4 p.c. Deb.	102—105	..	3 16 2
120,000	Stk.	Aug. 27	6	Tottenham and Edmonton — A. 5 p.c.	115—120	..	5 0 0
313,020	,,	,,	4½	Tottenham and Edmonton — B. 3½ p.c.	95—100	..	4 10 0
182,380	10	June 11	8	Tuscan, Ltd.	8—9	..	8 17 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	58—100	..	5 0 0
737,142	Stk.	Aug. 13	5	West Ham, 5 p.c. Ord.	94-98	..	5 2 0
				WATER COMPANIES.			
781,517	Stk.	June 26	12†	Chelsea, Ord.	305—315	+5	3 16 2
150,000	,,	,,	5	Do. 5 p.c. Pref.	140—143	..	3 9 0
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	131—136	..	3 6 2
175,785	,,	Sept. 30	4½	Do. 4½ p.c. Deb.	132—137	..	3 5 8
1,720,560	Stk.	Oct. 15	8	East London, Ord.	215—220	−2	3 12 9
654,740	,,	Dec. 11	4½	Do. 4½ p.c. Deb.	133—138*	..	3 5 3
1,282,943	,,	,,	3	Do. 3 p.c. Deb.	87—90*	..	3 6 8
700,000	50	Dec. 11	10	Grand Junction — 10 p.c. max.	132—135*	+ 6	3 14 1
310,000	Stk.	Sept. 30	4	Grand Junction — 4 p.c. Deb.	115—120	..	3 6 8
708,000	Stk.	Aug. 13	10	Kent	285—290	+17½	3 9 0
160,000	,,	,,	7	Do. New, 7 p.c. max.	150—200	+5	3 10 0
1,043,800	100	June 26	11	Lambeth, 10 p.c. max.	290—295	+2½	3 14 7
406,200	100	,,	8½	Do. 7½ p.c. max.	215—220	+2½	3 17 3
350,000	Stk.	Sept. 30	4	Do. 4 p.c. Deb.	115—120	..	3 6 8
500,000	100	Aug. 13	12 5/8	New River, New Shares	305—315	..	4 1 3
1,000,000	Stk.	July 29	4	Do. 4 p.c. Deb.	115—120	..	3 6 8
902,300	Stk.	June 11	7½	Southwark and Vauxhall — Ord.	238—243	+10½	3 1 9
126,500	100	,,	7⅛	Southwark and Vauxhall — 7⅛ p.c. max.	200—210	..	3 11 5
489,200	Stk.	,,	5	Southwark and Vauxhall — 5 p.c. Pref.	140—145	..	3 9 0
1,019,585	,,	Oct. 15	4	Vauxhall 4 p.c. A Deb.	115—120	..	3 6 8
1,155,066	Stk.	Dec. 11	10	West Middlesex	290—295*	+1½	3 7 9
200,000	,,	,,	4½	Do. 4½ p.c. Deb.	130—135*	..	3 6 8
200,000	,,	Sept. 11	3	Do. 3 p.c. Deb.	88—91	..	3 5 11
					* Ex div.		

† Next dividend will be at this rate.

and £10,249); 1908, £23,917 (£17,138 and £6779); 1909, £21,417 (£17,513 and £3904); 1910, £18,820 (£17,888, and £932). No assumptions were made from 1911 to 1914, as all the capital authorized by the Company's Acts was estimated to have been expended by March 31, 1910. Table 2 showed that the average of five years proportion of maintenance and management expenses to income (1899 to 1903) was 4·44. In future 4·2 was taken, to allow for contingencies, including the growth in rates and taxes. Another table showed that the average yield for the ten years 1894 to 1903 to a shareholder in the West Middlesex Company's ordinary consolidated stock was £3 8s. 5d., as against £2 14s. 6d. to a shareholder in Metropolitan Consolidated 3 per cent. stock. The average yield during the last three years was £3 9s. 11d. on the former stock, and £2 19s. 1d. on the latter.

Mr. CRIPPS, in cross-examination: I think I need not trouble you, because your Table No. I. shows that we can pay 10 per cent. all through?

Witness: Yes; I think so.

Mr. *William Plender*, examined by Mr. J. D. FITZGERALD, presented tables showing that the total proceeds from the issue of capital was £2,321,821 18s. 2d. (the nominal amount being £2,306,232 13s. 4d.), and the sum remaining unissued at March 31 last was £157,480 15s. 2d. A further table showed that the net profit available for dividends had risen from £82,245 in 1872 to £120,956 in 1903. The Company had paid 10 per cent. dividends since 1888, with rebates steadily rising from £2715 in 1888, and £10,439 in 1889, to £29,104 in 1902. In 1903, the amount was £18,650. From 1880 to 1887, considerably over 10 per cent. had been paid; the maximum being 12·53 per cent., in 1880. Each year from 1873 to 1879 inclusive 9·83 per cent. had been paid, and 10·55 per cent. in 1872. The average for the last 32 years had been 10·31 per cent. The total net income required to pay the maximum dividend of 10 per cent. when all the debenture capital subject to the sinking fund had become liable to contribution would be (disallowing 1 per cent. for management) £157,385. The average Stock Exchange value of the consolidated stock on Dec. 14 last was 270, with a yield of 3·703 per cent. The number of years' purchase was 27. The average value of the 4½ per cent. debenture stock on the same date was 132½, 3·396 per cent., and 29·45 years' purchase; of the 3 per cent. debenture stock, 89½, 3·352 per cent., and 29·83 years' purchase; and of the debenture stock of the Staines Reservoirs Joint Committee, 88½, 3·390 per cent., and 29·50 years' purchase.

Mr. *J. G. Griffiths* said he had considered the accounts presented by the Water Board's Accountants, and agreed with them. He put in a table showing the operation of the Chamberlain's sinking-fund clauses (three years after the issue of debenture stock) in relation to the payment of a dividend of 9 per cent. on £1,155,066 of debenture stock and interest on debenture stock issued at March 31 last, including Staines stock. On the assumption that all the capital earned the profit proportionately, the table showed that the sinking fund received £29,330 out of a total of £41,298 attributable to £949,186 of debenture capital. During the existence of the Company, the sinking fund would receive £19,838 annually; and the ordinary stockholder would benefit to the extent of £21,460 per annum by the debenture capital subject to the sinking fund.

Thirty-Fourth Day—Monday, Dec. 21.

Mr. *C. A. Jones* said he had considered the claim made by the Company for the costs, charges, and expenses of winding up (other than costs incurred in the arbitration), and thought it was very much exaggerated. In his view, the amount should be £2500.

In cross-examination by Mr. CRIPPS, witness agreed that if a special sum was voted in remuneration of special services rendered to the Company by their officers, this was not a matter which should come into the taxation of costs as between the parties. He also agreed that it was a question whether such matters should be taken into consideration by the Court.

Mr. MOULTON said this concluded the evidence he proposed to call. Summing up on behalf of the Water Board, he said that the Company had paid maximum dividends, and the position of the revenue to the shareholders was that it was sandwiched between certain prior charges and a certain margin. In following the revenue so situated, it was exactly like an improved rental value of a house. On the figures supplied by Mr. Haward, he said that practically the margin had disappeared in 1905. He quite agreed that this was not the sole protection which the shareholders had, because they had a reserve fund which would be quite sufficient to secure their maximum dividend. But the position unquestionably was that there was a large prior charge of £50,000 to £60,000, which must in future come before their maximum dividend of £115,000. The margin beyond this was at present *nil*; and in the immediate future, even according to Mr. Cripps' figures, it would be *nil*. So that they would be living on their reserve fund. Although no doubt the income would increase, it was not a case in which, according to Mr. Griffiths's description, the income was supported by a large surplus. It was supported by a surplus, and no doubt something exceptional would have to occur before they would actually get below their maximum dividend; but it was a far less clear maintainable income than, for instance, the prior charge of £50,000 or £60,000 on the whole undertaking.

The PRESIDENT said if there were abnormal circumstances in one year, the Company had power of recoupment in subsequent years.

Mr. MOULTON said he did not deny that it was a maintainable income; but he pointed out that it was not of the certain order represented by the prices of debenture stock in the Company, or the Staines debenture stock, all of which prices were before the Court. The stability was entirely due to the Staines reservoirs scheme. Without this, even on his learned friend's figures, a few years of income was all they could expect before they were in default; and no suggestion was made of any way in which they could carry on the business in default, other than by the use of the water going to Staines. Therefore, in

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excluding the advantages which came from the Staines powers, this would exclude that which alone gave stability to the income. But for the Staines powers, the Company, either in 1904 or 1905 as the Water Board said, or in 1905 as the Company said, would practically be at the end of their resources, or be in default.

Mr. CRIPPS, in summing up on behalf of the Company, said that the sterilization point was the real one in dispute between the parties. He joined issue with his learned friend, and maintained that, having regard to the position of the Company, the matter of security was not affected either one way or the other by the sterilization clause in the Staines Act. Mr. Moulton had not contended that the Company had not a maintainable income up to 10 per cent. They gained nothing, except in regard to security, for showing anything beyond this. His learned friend had directed the whole of his attack to the security of the income. He (Mr. Cripps) had not thought it necessary to cross-examine Mr. Haward, because he admitted in Table 1 that 10 per cent. could be paid right through. Then it was pointed out that an increasing margin of security was obtained as time went on; and in the event —which was not contemplated even in the figures of the Water Board— of the 10 per cent. not being paid, it could be made up in subsequent years. It was admitted by Mr. Moulton that the only matter for the judgment of the Court, apart from one or two minor points, was as to the security, which went to the number of years' purchase. He had assumed that if the sterilization clause had not been passed, the Company would have been in the position of maintaining its income, and was entitled to 36·36 years' purchase on the ground that not only was it certain, but there was a large margin behind them; so that it was impossible that the income *per se* could be affected in the future. He contended that the words in section 84, which did not allow the Company to bring into account anything in respect to any advantages conferred on them by the Act, had reference to specific exceptional advantages, and had nothing to do with the raising of capital. Where a company had public duties to perform, Parliament always provided powers and enabled the raising of the necessary money; and no question of default could arise.

Mr. MOULTON said this was a statement of fact about which he had not been allowed to give any evidence. He could show there were cases in which Parliament had deliberately refused.

Mr. CRIPPS, continuing, contended that an "advantage" conferred by the Act would be supposing it empowered the Company to make a dividend of £15,000 where it only made £10,000 before. The extra £5000 could not be claimed. It was quite clear that the Company did not get any advantage in income from the Staines Act; and Mr. Moulton did not maintain that they did. He did not understand in what way his learned friend supported his contention that the sterilization clause had the effect of diminishing the number of years' purchase.

After a short adjournment,

The PRESIDENT gave his award in the following terms: We find that the sum to be paid by the Metropolitan Water Board to the West Middlesex Company, including allowances for recoupment of any loss of interest pending the investment, as well as for the costs of the investment, and also for covering any costs, charges, and expenses, other than costs in regard to this arbitration, which have been, or are likely to be, incurred in consequence of the passing of the Metropolis Water Act, 1902, and which ought, in the opinion of this Court, to be borne by the Water Board, is the sum of £3,524,000. Provided always that payments hereinbefore contracted to be made good shall be independent of, and in addition to, the transfer in the 4th section of the Act mentioned of all debts, debenture stock, or rent charges, or other annual payments, and also of any payment directed to be made under section 40 of the Act. Provided also that this finding and award shall not derogate from the power of the Court to settle and determine any matter or question, excluding the matters hereby determined, but including any adjustment of accounts between the parties which is incidental to the matters by the Act referred to the Court or consequential thereon.

In reply to the President, Mr. MOULTON and Mr. CRIPPS said they had no observation to make on the form of the award.

The PRESIDENT: Then we make a similar order to those we have already made with regard to costs—between solicitor and client.

The Court adjourned till Jan. 18.

COMPLETION OF A CUMBERLAND WATER SCHEME.

The important gravitation water scheme promoted by the Aspatria, Silloth, and District Joint Water Board, under an Act of Parliament obtained in 1901, is practically complete, and the turning on of the water at Silloth last week marks the satisfactory termination of a project which, first mooted in 1899, had for its object the tapping of the Cumberland Hills and the conveying of the water through a hitherto badly supplied district to the North-West Cumberland coast town of Silloth, a thriving health resort, which is popularly known as "Carlisle-by-the-Sea." The original partners in the scheme were the Aspatria and Holme Cultran Urban District Councils and the Wigton Rural District Council; but the latter Authority, disinclined to face the financial burden, withdrew after the promoters had gone to Parliament. Right into the heart of the Cumberland Hills the promoters have gone for their supply. The streamlets that go to form the River Ellen (the watershed is about 2261 acres) have been collected in a huge reservoir at Chapel House, near Uldale, and thence are conveyed in iron pipes along a route which includes several villages and the towns of Aspatria and Silloth. The distance from the intake to the sea is a little more than 19 miles. The quality of the water is stated to be excellent. The sum of £35,000 was named in the Bill as the probable cost; and the expenditure on the works alone so far has been much in accordance with anticipations. The Engineers are Messrs. Pickering and Crompton, of Whitehaven.

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	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	ACCRINGTON	500,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	TONBRIDGE	300,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	STRETFORD	500,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	OLDBURY	300,000
BIRKENHEAD	2,250,000	ST. CATHERINES (Second Contract)	250,000	TODMORDEN	500,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	YORK (Second Contract)	750,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	ROCHESTER (Second Contract)	500,000
HALIFAX	1,000,000	YORK	750,000	NEWPORT (MON.)	250,000
TORONTO	250,000	ROCHESTER	500,000	TOKIO, JAPAN	1,000,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	PERNAMBUCO (Brazil)	125,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	MALTON	150,000
MONTREAL	500,000	DULUTH, MINN.	300,000	DULUTH, MINN. (Second Contract)	300,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	BROCKVILLE (ONT.)	250,000
BELLEVILLE	250,000	LEICESTER	2,000,000	SMETHWICK	500,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	GRAVESEND	300,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	NEWPORT MON. (Second Contract)	250,000
		BURNLEY	1,500,000	TORONTO (Third Contract)	750,000
		KINGSTON-ON-THAMES	1,750,000	TORONTO (Fourth Contract)	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.
MONTREAL, ONT. (Second Contract) . . . . . 1,800,000 Cub. Ft.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In presenting a brief summary of the events of the year which is about to close, it is not my intention to enter into details. The year has not been marked by much more than the ordinary progress in the volume of business, which, happily, continues to be maintained. The places are very few indeed where a substantial increase was not experienced. Reductions of 3d. per 1000 cubic feet were made in Glasgow, Edinburgh, Dundee, Dunfermline, Montrose, Dalkeith, Kirkcaldy, and other places. Perth reduced by 4d., Hawick by 2½d., Kelso by 5d., Cambuslang by 2d., Selkirk by 2½d., Kirkintilloch by 6d., Alloa by 2d., Largs by 5d., Gourock by 4d., Coatbridge by 2d., Greenock by 5d., Falkirk by 2d., Dumfries by 6d., Hamilton by 5d., Helensburgh by 5d., Crieff by 5d., Brechin by 3d., Stirling by 4d., and Cupar by 3½d. The greatest reduction of all was at Arbroath, where the price was brought down from 4s. 4½d. to 3s. 6½d.—a reduction of 10d. The lowest prices charged for gas in Scotland now are at Glasgow and Hamilton, where the price is 2s. 1d. per 1000 cubic feet.

The greatest event of the year in gas affairs in Scotland was the formal opening of the Granton Gas-Works, on the 27th of February. These have so justified the outlay which has been made upon them that the Gas Commissioners have resolved to proceed with a scheme for the practical doubling of the capacity of the works. New gas-works were opened at Newport (Fife), and at Ardrossan. Extensive new plant was erected at Dunfermline, Dumbarton, Aberdeen, Perth, and elsewhere. Good progress has been made with the erection of the new Provan Gas-Works—now nearing completion. This list shows a sustained activity in gas-works construction, which is encouraging.

Three Managers were removed by death from active service—viz., Messrs. William Foulis, of Glasgow; J. Thomson, of Inverness; and John Devine, of Auchinleck. In addition, the deaths were recorded of Messrs. Andrew Tait, of Peebles, and W. Smith, of Helensburgh, both of whom had retired from active service.

The list of changes is a large and unfortunate one. The most important, and an exceedingly popular one, was the appointment of Mr. Alex. Wilson, of Dawsholm, to be Gas Engineer to the Corporation of Glasgow, in succession to the late Mr. William Foulis. At the present moment, there are three posts of Manager vacant in Glasgow—Provan, Dawsholm, and Tradeston. There have been changes in the managership in as many places as Glasgow, Inverness, Stranraer, Kirkcudbright, Stonehouse, Strathaven, Innerleithen, Tranent, Newport, Kirkcaldy, Fraserburgh, Galashiels, Falkirk, Aberdeen, Broughty Ferry, Peterhead, and Wishaw. Two of these have been brought about by retirement; Mr. A. Smith having relinquished his appointment at Aberdeen, and Mr. A. MacPherson at Kirkcaldy—both, it is to be regretted, on account of bad health.

The price of coal has gone down steadily all the year; the total fall being not less than a shilling per ton, and in the case of splint as much as 1s. 9d. per ton.

I do not recall any transfers in the course of the year. One was all but completed at Airdrie; but, on account of a difficulty with the Coatbridge Gas Company, who advanced a claim to have statutory powers within the burgh of Airdrie, it went off. The subject is now in Parliament, and will most probably result in a transfer. A new Gas Company has been formed, to supply gas in the Shotts district of Lanarkshire—a very populous district which does not yet possess gas-works. Another new Company is spoken of being formed for Larbert and the district, which is at present supplied by the Falkirk Corporation.

We have not got very far forward with the settlement of what is to be done to place the Dundee Gas-Works in a position to adequately provide for the consumption. The Gas Committee met on Monday; and after a long discussion upon Mr. Yuill's report (which appears on p. 829), it was agreed to postpone consideration of the subject for a month, by which time the whole question can be more fully dealt with. In the course of the discussion, it was, it is stated, generally admitted that the storage accommodation in the works is insufficient, and that the best way to remedy matters would be to complete the works as shown on plans prepared by the late Mr. William Foulis and Mr. Yuill; but this involved an expenditure of something like £50,000, which several of the members did not care to incur, seeing that, by the introduction of carburetted water-gas plant, the necessities of the city would be met, and a splendid stand-by provided in case of accidents. Stress was laid by several members on the alleged danger of using the gas for domestic purposes; and it was suggested that the Medical Officer of Health should be asked to give his views upon the subject. On Mr. Yuill being asked for his opinion, he pointed out that in America 75 per cent. of the whole gas consumption is carburetted water gas, and that in towns in this country where the gas is in use, neither in the manufacture nor in the burning of it is it attended by any greater hazards than coal gas.

At the meeting of the Edinburgh Town Council last Tuesday, after the question of the quality of the gas supply had been dealt with (see p. 828), notice of motion was given by Bailie Mallinson and Bailie M'Michael that it be remitted to the Cleaning and Lighting Committee to consider and report upon the subject of lighting the city, except the portion of it which is lighted by electricity, with incandescent gas.

In the Sheriff Small Debt Court at Perth last Tuesday, an action came on for hearing in which the Corporation of Perth sued Mr. John Gorrie for £1 3s. 2d. for gas supplied. Gorrie said he had always offered to pay for the gas consumed in his house; but he would not pay for the gas used for lighting the common stair. When the collector called, he offered to pay the account, less 10d. for the stair gas. He found six months ago, he said, that the gas used for lighting the stair was supplied through the meter in his house. Mr. Begg, the Town Clerk, stated that the Town Council arranged with the proprietors of buildings to collect from the tenants the amounts due for stair lighting, but that in some instances the tenants refused to pay; and in such cases

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New Year

with

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&C.,
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they charged the proprietors, who recovered from the tenants. The Sheriff asked if Mr. Begg would take decree for £1 2s. 4d. Mr. Begg said he would, if the defender would pay the expenses. The defender said he would not pay the expenses of the action. After some consideration, Mr. Begg said he would accept the £1 2s. 4d.; and decree was given for that amount—neither party getting expenses.

In connection with the appointment of Mr. J. Hamilton, Assistant at Rothesay, to be Manager of the Kirkcudbright Gas-Works, in succession to Mr. D. Irvine, announced in the "JOURNAL" last week, the Council first discussed the propriety of conducting the proceedings in private, but resolved that they be taken in public. Mr. Miller proposed the appointment of Mr. Hamilton. Mr. Brown thereupon moved that Mr. Irvine be re-appointed. Eventually Mr. Hamilton obtained the appointment by 12 votes to 4.

The Falkirk Town Council have at last taken a definite step in the direction of providing new gas-works for the town and district. The Gas-Works Committee, on the 15th inst., had before them a report (given on another page) which their Engineer and Manager—Mr. W. M'Crae—had prepared on the subject at their request. They approved of it, and ordered it to be printed and circulated among the members of the Council. They also appointed Mr. M'Crae Engineer of the new works—reserving to themselves power to appoint a Consulting Engineer, or to consult any engineer whenever they considered this necessary. Mr. M'Crae was also instructed to prepare plans for the new works. It was agreed to visit the Granton Gas-Works, to see the carbonizing plant there. This report having been laid before the Council on Monday, they approved of it. They also forwarded in some degree the negotiations with the North British Railway Company with reference to railway access to the works. It is a pleasure to be able to state that there was entire unanimity as to proceeding with the new gas-works. There was only one note of objection; but it had reference to the question of whether or not the Larbert district may separate from Falkirk and erect gas-works of their own. The proposal was to confer with the County Council on the subject before adopting the recommendations of the Committee; but the proposal was allowed to drop. It may, however, be brought forward again.

The Gas Committee of the Aberdeen Town Council on Wednesday considered the report of Mr. S. Milne, the Engineer and Manager, upon the charge for gas supplied through prepayment meters, which was given in the "JOURNAL" for the 15th inst.; and they approved of it, and ordered it to be laid before the Council for the information of the members.

The Lochwinnoch Gas Company is the last of the year to hold their annual meeting. It was held on Thursday; and the shareholders got a Christmas present of a 4 per cent. dividend, free of income-tax.

A case of poisoning by gas, which resulted in the death of one man, occurred in Dundee on Monday night. William Tadden and his wife occupied a dwelling in Union Street, in the northern district of the city. On Saturday, Mrs. Tadden had stated to a neighbour that there was a smell of gas in their house, and that she was going to report it. She did not do so, however. On Monday evening, a son and his wife called to see the aged couple. They did not receive a response to their knocking at the door, and the house was forcibly entered. Both the inmates were found in bed. There was a strong smell of gas in the house, and the gas-jet above the fire-place was burning at a "peep." Tadden was discovered to be dead, and his wife was unconscious; but she recovered. It was found that the service-pipe was fractured behind the meter.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 24.

Sulphate of Ammonia.

The demand has been well sustained, especially in Scotland, where supplies have become scarce and where the highest prices are consequently being paid. The closing quotations are £12 7s. 6d. per ton f.o.b. Hull, £12 8s. 9d. per ton f.o.b. Liverpool, and £12 12s. 6d. per ton f.o.b. Leith. Purchases have also been made for January delivery at an advance on the above prices f.o.b. Liverpool and Hull. In the forward position, £12 10s. per ton has repeatedly been paid, f.o.b. Leith, for July-December. For delivery over the spring months, business is hindered by the firmness of makers, and any orders booked have been taken speculatively. The value is about £12 15s. per ton f.o.b. Leith. London, Beckton terms, is also quoted £12 15s. per ton for near months.

Nitrate of Soda.

This article is increasingly firm in all positions, and spot quotations are 9s. 9d. per cwt. for ordinary quality and 10s. for refined.

LONDON, *Dec.* 24.

Tar Products.

The market in tar products is very dull; and there is practically nothing doing for early delivery. The only prices which can be given for pitch are those which have been actually realized for forward contracts, as at present makers ask much higher prices for prompt delivery than buyers are willing to pay. There is very little demand for early delivery; but there are several inquiries for the last half of next year, consumers doubtless thinking it wise to cover their requirements for this period. The demand for 90 per cent. benzol is very good; but there is very little offering. At the same time, one or two makers have shown a desire to sell for forward delivery; and it is reported that 10½d. had been accepted for January-June next year. In 50-90 per cent., the position remains unchanged; and consumers do not appear at all anxious to purchase. There is nothing fresh to report in toluol; and there is practically none offering at the moment. In solvent

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naphtha and anthracene, the position remains unchanged; and there is an absence of business in these articles. Creosote is very firm, especially in London; and the demand continues very strong in the north.

The average values during the week were: Tar, 22s. 6d. to 27s. Pitch, London, 39s. 6d. to 40s.; east coast, 36s. to 37s. 6d.; west coast, 35s. to 36s. 6d. Benzol, 90 per cent., 10¾d. to 11d.; 50-90 per cent., 7¾d. to 8d. Toluol, 7¾d. to 8d. Crude naphtha, 3½d.; solvent naphtha, 9½d. to 10d.; heavy naphtha, 11d. to 1s. Creosote, London, 1⅞d.; North, 1⅝d. Heavy oils, 2¼d. to 2½d. Carbolic acid, 60 per cent., 1s. 6d. to 1s. 6½d. Refined naphthalene, £5 to £8. Salts, 23s. 6d. to 25s. Anthracene, "A" quality, 1¾d. to 2d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

The market continues to improve, and prices are well maintained. As far as London makers are concerned, both Beckton and the South Metropolitan appear practically out of the market for early delivery, and do not care to offer for January. Prices therefore are purely nominal. The Leith market continues very firm; and it is reported that £12 8s. 9d. has actually been paid for prompt sales. Makers decline to consider business, forward delivery, even at £12 10s. In Hull, the demand is very good, and sales are reported at £12 7s. 6d. for early shipment. Business at Liverpool has been done at £12 5s. to £12 6s. 3d. for prompt delivery, but only for limited quantities; and the market closes firm at £12 7s. 6d. to £12 8s. 9d. The outlook forward is certainly very strong.

LANCASHIRE COAL TRADE DURING 1903.

Except that the year has closed with a fairly active inquiry for most descriptions of round coal, with rather a tendency towards stiffness in prices, the immediate outlook is not at all satisfactory. Unless a spell of severe weather gives briskness to the house-fire coal trade, a very general quietude of demand may be looked for in the better qualities of round coal after the holidays. With regard to other descriptions of fuel, depression throughout the engineering and iron trades, and the very unsatisfactory position of the cotton trade, do not present anything like a hopeful prospect for the lower qualities of round coal and engine classes of fuel. As to the year that is now closing, the coal trade opened with a fairly steady tone generally; but it was not long before a weakness came over the market, from which, so far as all descriptions of round coal are concerned, there has since been no real recovery—the tendency of prices being for the most part gradually downwards, representing a reduction on the twelve months of about 1s. per ton on the ordinary current rates, and 3d. to 6d. on the large locomotive fuel and gas-coal contracts as compared with the preceding year's prices, which were then cut low to effect settlements. Engine classes of fuel have undergone considerable fluctuation, owing to the somewhat abnormal condition of the round coal trade.

The lower qualities of round coal used for steam and forge purposes during the early part of the year met with a fairly good demand, which kept the common coal pits on full time; and collieries had no difficulty in disposing of their output. With gradually lessening activity, however, in the engineering, iron-making, and manufacturing trades, and other large coal-using industries, depression also came over this branch of the coal trade. Coals which in January were quoted from 8s. 3d. and 8s. 6d. up to 8s. 9d. and 9s. per ton, got down to 7s. 9d. and 8s. 3d. This weak position of the market brought about the inevitable pressure on the part of railway companies and users of gas coal. The Lancashire colliery owners in the settlement of the 1902 gas-coal contracts having had to concede a general reduction of 1s. to 1s. 6d. per ton, and on the locomotive fuel contracts of 1s. per ton, on the previous year's prices, naturally resisted very strongly any further material reduction. Some giving way became, however, necessary; and the contract basis of prices was practically fixed by several large settlements early on in the season at 3d. to 5d. per ton under the 1902 rates. As the season advanced, a reduction of 5d. was in most cases conceded; and the average basis for the 1903 gas-coal contracts was about 8s. 3d. and 8s. 9d. up to 9s. for ordinary screened Wigan four-feet, 9s. 3d. to 9s. 6d. and 9s. 9d. for best screened Wigan Arley, and 6s. 6d. to 7s. per good gas-making slack.

The very indifferent inland demand for steam and forge purposes has compelled collieries to seek an outlet for surplus production at the ports; and on clearance for shipment extremely low prices have been accepted rather than attempt to force sales on the home market, which would only bring about a further weakening in the inland trade generally. For shipment on special sales, prices have been taken which have represented not more than about 7s. per ton at the pit; and 7s. 6d. has been a very common figure. The shipping trade at the Lancashire ports—both the Mersey and the Manchester Ship Canal—has all through the year been only of an indifferent character. Considerable fluctuation has marked the course of the engine fuel trade. At the commencement, good qualities of slack were firm at about 6s. 6d. to 7s., medium 5s. 6d. to 5s. 9d., and common sorts 4s. 6d. to 4s. 9d. at the pit. The demand for slack, however, was not above the average; and it was mainly the lessened production that gave strength to the market. With a return to something like normal conditions, prices generally tended in an upward direction; the closing quotations averaging about 4s. to 4s. 6d. for common, 5s. to 5s. 6d. for medium, and 6s. to 6s. 6d. and 6s. 9d. for the best engine slack.

Wages and labour questions have been somewhat prominent during the past year, although they have not been a cause of any serious disturbance to trade. Early on, a somewhat uneasy feeling was created by the action of the South Wales Miners ignoring the distinctly set forth policy and representations of the Federation by entering upon a three years wages settlement on their own account. The possibility of the Federation calling a general strike was talked of, and a "threatened crisis" freely discussed. The market, however, was very little affected, and the whole matter was allowed to subside. The termination, with the close of the year, of the Coal Trade Conciliation Board

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has also in many quarters been anticipated with no little anxiety. Twice during the past year has the Board been called upon to decide the question of wages in the Federated area. The coalowners, unsuccessful on the first occasion in obtaining any concession, renewed their application, and asked for a reduction of 10 per cent. As this renewed question of wages was being brought forward close upon the period when the Conciliation Board would lapse unless mutually renewed, and the reduction in wages being strongly opposed by the miners as altogether unwarranted, there was much apprehension whether the situation thus created might not lead to a break up of the Board. The coalowners being strongly insistent upon the necessity of a substantial reduction in wages, there was the further fear that, with a break up of the Board, any reduction in wages might be resisted by a strike; and a very general feeling of uneasiness as to the future towards the close of the year gradually came over the market. After considerable negotiation, mutual concessions seemed to have brought about a satisfactory compromise, which might form the basis for a renewal of the Conciliation Board. These conditions were, however, rejected by the miners, mainly because they involved a reduction in wages of 5 per cent., and, as a result, the settlement of the question was left in the hands of Lord James, who awarded a reduction of 5 per cent. This represents a very unsatisfactory position with the close of the year.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade has been very brisk; but the holiday interruption limits the production now. In steam coals, best Northumbrian kinds are steady at about 9s. 6d. per ton f.o.b., second-class steams are from 8s. 3d. to 8s. 6d., and steam smalls about 4s.—the latter being relatively plentiful, for there is not the American demand, known a year ago, to take up the heavy output. In the gas coal trade, there have been a few contracts entered into for next year's export trade, but not for large quantities. For occasional cargoes, the quotations range from about 8s. 3d. per ton f.o.b., up to perhaps 9s. for the best Durham gas coals. At present, the demand on the large contracts is so heavy that it leaves only a small margin for sale. This keeps the market firm; but after a few weeks, there will be more in the market. Gas coke is irregular, because, in spite of the large production, some of the great local companies have not much for sale. About 14s. 6d. up to 15s. per ton f.o.b. is asked for good qualities.

Scotch Coal Trade.

"Fairly active" is all that can be said of the coal trade, which is scarcely to be accounted for by the season of the year, but, it is to be feared, points to a want of work in the manufacturing trades. The prices quoted are: Main, 7s. 6d. to 7s. 9d. per ton f.o.b. Glasgow, ell 8s. 6d. to 9s. 6d., and splint 9s. 3d. to 9s. 6d. The shipments for the week amounted to 225,877 tons—a decrease upon the preceding week of 4811 tons, and upon the corresponding week of last year of 11,859 tons. For the year to date, the total shipments have been 10,953,499 tons—an increase of 108,385 tons upon the same period of last year.

The Stepney Council's Electric Light Undertaking.—An attempt was made on Wednesday last, at a meeting of the Stepney Borough Council, to rush through certain recommendations made by the Electric Lighting Committee for the extension of the service under their control. The Committee, however, did not furnish the Council with any statement as to the present financial position of the undertaking; and the question was referred back until such a statement is forthcoming. The matter involves an expenditure of more that £78,000, which it is proposed to raise by a loan from the London County Council.

Meter Testing at Exeter.—Mr. H. A. Willey has written to the Exeter City Council stating that the question of testing his firm's meters under the Sales of Gas Act in relation to the new factory which they are building, has arisen. The testing has increased enormously, and a convenient public testing-office is essential, equipped with testing apparatus to meet modern requirements approved by the Board of Trade. The firm propose that they should build a testing-station adjoining the new factory, with offices of adequate size for the purpose, on their own land, and charge them a rental of £50 per annum for the use of it. The sum, Mr. Willey is advised by the Surveyor, is a just and reasonable equivalent for the capital outlay the firm propose to make. Mr. Willey suggests that the Council should undertake the provision of the scientific appliances required, and that it would be better that they should be supplied independently of the firm. The estimated outlay for this purpose is £500. Mr. Willey adds that the present apparatus is obsolete and worn out, and that the Council's Inspector is therefore working under great difficulty and much inconvenience to the firm. The letter has been referred to Committee.

Return of Messrs. Willey's Employees from America.—It will probably be remembered that in the "JOURNAL" for the 17th ult. we recorded the departure on that day of a deputation of the employees of Messrs. Willey and Co., of Exeter (accompanied by two representatives of labour organizations and friendly societies), for America, in order to study the conditions affecting labour, the fiscal policy, education, and other matters. The centres covered by the deputation during their travels included Providence, Boston, Syracuse, Buffalo, Toronto, Niagara, Pittsburgh, Washington, Philadelphia, and New York. The tour was highly instructive from a commercial point of view, and the visitors were everywhere received with the utmost cordiality. They left New York for England on the 15th inst., and arrived at Plymouth on Monday morning last week. They were met by Mr. T. Glanfield, Mr. H. Grove (Chief Engineer), and Mr. W. Bailey, representing the firm; and they all dined together at the Duke of Cornwall Hotel. The party left Plymouth for Exeter, where they were met by other representatives of the firm. It transpired at the dinner that the Mayor (Mr. F. J. Widgery) and the Mayoress had invited several of the citizens to join in welcoming the delegates home at the Guildhall yesterday evening.

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The North-Western Power Gas Company have deposited plans with the Town Clerk of Glossop for acquiring a plot of land on which it is proposed to build a new generating station at Hadfield.

The New River Company, as will be seen by an announcement which appears in our advertisement pages, are inviting tenders for an issue of £100,000 of "C" debenture stock, and £200,000 of "D" debenture stock. The dividend on both stocks is 3 per cent.

A recommendation of the Public Control Committee of the London County Council to entrust the work of removing and relaying the mains at the Westminster Gas-Meter Testing Office to Messrs. Parkinson and W. & B. Cowan, at an estimated cost of £70, was agreed to at the meeting of the Council last Tuesday.

Mr. Maurice Graham, of Messrs. Graham, Morton, and Co., Limited, of Leeds, has just returned from the Continent, after having made a lengthy business tour in France, Germany, and Austria in connection with gas matters.

Yet another case of suicide by means of coal gas falls to be reported this week; an inquest having been held at St. Pancras on Saturday on the body of George William Carr, aged about 45, who was found dead with a gutta-percha tube leading from a gas-burner inserted in his mouth, where it was kept fixed by two pieces of string fastened at the back of his head. It was stated that latterly the deceased had appeared to be in want of money, and that he owed his landlady a week's rent. The Jury returned a verdict of "Suicide."

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

SECRETARY AND ASSISTANT-MANAGER. Bridlington Gas Company. Jan. 9.
MANAGER. Portland Gas-Works. Jan. 7.
DRAUGHTSMAN. No. 4142.
CLERK for Cape Town. Cape Town Gas Company London.
WORKING MANAGER. Mickleover and Etwall Gas Company.
DISTRIBUTING FOREMAN (Water-Works). No. 4143.
WORKING FOREMAN. Exeter Gas-Works.
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Sales of Stocks and Shares.

CROYDON GAS COMPANY. Jan. 19.
LOWESTOFT WATER AND GAS COMPANY. Jan. 19.
NEW RIVER COMPANY. Jan. 14.
SHREWSBURY GASLIGHT COMPANY. Jan. 27.
SOUTH METROPOLITAN GAS COMPANY. (Consumers and Employees only).

TENDERS FOR

Coal.

COPENHAGEN LIGHTING DEPARTMENT. Tenders by Jan. 19.

Engine and Exhauster.

ORIENTAL GAS COMPANY. Tenders by Jan. 5.

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BELFAST GAS DEPARTMENT. Tenders by Dec. 31.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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BALE & CHURCH will be pleased to send Samples and Quotations, and make Offers for SPENT OXIDE.
BALE'S FIRE CEMENT, PAINT, AND GAS COAL
5, CROOKED LANE, LONDON, E.C.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
SURREY ENGINEERING WORKS, BLACKFRIARS ROAD, LONDON, S.E.
Telephone: 1693 HOP. Telegrams: "LUMINOSITY."

ADVERTISER, Age 30, seeks re-engagement at the end of January as FITTINGS INSPECTOR. Practical knowledge of Gas-Fitting in all branches, including Automatic Work. Well up in the control of Workmen, Time Sheets, and the reading of Meter Indices. Capable of superintending Show-Rooms. References.
Address No. 4145, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Working Foreman with a good knowledge of Regenerative Firing and Mechanics, and accustomed to the routine of a Gas-Works making about 300 Millions per Annum. House, Coal, and Gas provided.
Apply, by letter, stating Age, Experience, Wages required, and where now employed, with three Testimonials, to the CHAIRMAN, Exeter Gas Company, EXETER, marked "Application."

WANTED, a good Fitter, used to Slot Installations and Meter and Stove Fitting.
State Age and Wages required, with References, to C. FOSTER VEEVERS, Secretary and Manager, Gas-Works, NORTHFLEET.

WANTED, a Smart Tinman thoroughly acquainted with making Dry Gas-Meters. Permanent employment for suitable man.
Apply, by letter, stating Age and Experience, and enclosing Testimonials, to No. 4144, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WATER-WORKS.

WANTED, a Foreman for Distribution Department. Population 80,000.
State Experience, with *copies* of Three recent Testimonials, Age, Wages required, &c., to No. 4143, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for Cape Town, a Clerk. One with knowledge of Gas Accounts preferred. Salary about £180 per annum. Passage paid.
Single men only need apply, by letter, to the SECRETARY, Cape Town and District Gas Company, Limited, 35, New Broad Street, LONDON, E.C.

DRAUGHTSMAN WANTED.

WANTED, immediately, a thoroughly practical DRAUGHTSMAN, well up in Steel Tanks, Gasholders, and Inclined Retorts.
Apply, by letter, with *copies* of References, to No. 4142, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MICKLEOVER AND ETWALL GAS COMPANY, LIMITED.

WANTED, a Working Manager. Make about 10 Millions. Regenerator Furnaces, Exhauster, &c. Able to lay Services, &c. House and Garden with Coal and Gas provided.
Apply, by letter, stating Age, Experience, and Wages required, not later than Jan. 4, 1904, to the SECRETARY, Gas Company, Etwall, DERBY.

SECRETARY and Assistant Manager wanted by the Bridlington Gas Company. Salary £250. Must be over Thirty Years of Age, and thoroughly experienced and competent in all the various duties involved in this appointment to a small up-to-date Gas Company.
Our make is about 100 Millions.
This is an absolutely open Competition, as we have no local or other Candidate in reserve.
The names of the candidates will not be made public.
Write only, in the first instance, not later than Jan. 9, to GEORGE BRAMBLES, Esq., Chairman and Managing-Director, Gas Company, BRIDLINGTON.

URBAN DISTRICT OF PORTLAND.

APPOINTMENT OF GAS MANAGER.

THE Gas-Works Committee of the Urban District Council of Portland invite APPLICATIONS for the Appointment of MANAGER of the Portland Gas-Works. Commencing Salary, £110 per annum, payable monthly, with House, Coals, Light, and Water free.
Applications, in candidate's own handwriting, accompanied by *copies* of Three Testimonials, must be sent to me, marked "Gas Manager," not later than Thursday, the 7th of January, 1904.
Candidates are requested to give the earliest date upon which they would be prepared to enter upon the duties if appointed.

JAMES HOWARD BOWEN,
Clerk to the Gas Committee.
Council Offices, Portland,
Dec. 21, 1903.

ATTERTON'S Patent Charging Machine, especially adapted for Small Works up to 50 Millions. Nearly 40 already supplied, and still supplying. Would soon repay for small outlay. Increased make and reduction in cost.
Apply to E. PADFIELD AND CO., 96 & 98, Leadenhall Street, LONDON, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

TO BE SOLD — Twin-Cylinder Gas- ENGINE, 6 n.h.p., by Crossley; Cylinders 8 in. diameter by 18 in. stroke, and Gas-Bag.
NEW GASHOLDER SHELLS, 40 feet diameter by 12 feet deep, and 50 feet diameter by 15 feet deep, with or without New Steel Tanks and Standard Guides.
Write J. WRIGHT, 181, Queen Victoria Street, LONDON, E.C.

GAS PLANT FOR SALE.

THE Ardrossan Town Council have for SALE at their old Gas-Works, Glasgow Street, Ardrossan, the following Plant—viz., Retort-Bench Fittings, Wrought-Iron Hydraulic Main, Vertical Steam-Boiler, Small Exhauster, Two Condensers (8-inch and 4-inch), Vertical Scrubber, Four Purifiers (12 feet square with or without overhead Lime Floor and Shed), Two Station Meters, Gasholder (40 feet diameter and 14 feet deep), Three Egg-end Boiler-Tanks, Small Tangye Pump, Piping Valves, Cocks, and other Castings.
Mr. A. Gillespie, Consulting Engineer, 65, Bath Street, Glasgow, will supply Particulars; and Offers are to be lodged with the Subscriber not later than the 15th of January, 1904.

JAMES COOK,
Town Clerk.
Ardrossan, December, 1903.

1500 Feet Cowan Station Meter, with 4-inch Connections and Bye-Pass Valves, in Good Working Order, FOR SALE.
SHEPSHED GAS-WORKS, LEICESTERSHIRE.

TAR Contracts Wanted on the Sliding- Sca'e or at Fixed Prices.
Managers and Secretaries desirous of selling to best advantage please communicate with DENT AND CO., Ouse Chemical Works, SELBY.

ORIENTAL GAS COMPANY, LIMITED.

TENDERS are invited for the supply of an ENGINE and EXHAUSTER capable of passing a Million cubic feet of gas in Twenty-four Hours.
Price f.o.b. Steamer to Calcutta.
Tenders and Specifications to be delivered at the Office of the Company, Finsbury House, Blomfield Street, London, E.C., on or before Jan. 5, 1904.

H. J. LUFF,
Secretary.

CITY OF BELFAST.

(GAS DEPARTMENT.)

TENDERS are invited for the supply of Wet (Compensating) and Dry METERS for One Year from the 1st of January, 1904.
Meters are to be delivered to our Stores in good order and Carriage Paid.
Tenders, endorsed "Tender for Meters," must be delivered at my Office not later than Thursday, the 31st of December, 1903.
The lowest or any Tender not necessarily accepted.

SAMUEL BLACK,
Town Clerk.

SHREWSBURY GAS LIGHT COMPANY.

DESIRABLE INVESTMENT.

THE Directors of the above Company invite TENDERS for
£10,000 SHREWSBURY GAS CONVERTED ORDINARY STOCK
Minimum Price of Issue, £110 per £100 Stock.
This Stock is entitled to a Standard Dividend of 5 per cent., payable half yearly; and the Maximum Dividend has been paid for many Years.
January 27, 1904, is the last day for the reception of Tenders.
Forms of Tender may be had on application to LLOYDS BANK, LIMITED, SHREWSBURY, or to the Company's SECRETARY, from whom any further Information can be obtained.

By order of the Directors,
WM. BELTON,
Secretary.
Gas-Works, Shrewsbury,
Dec. 17, 1903.

TENDERS FOR GAS COAL.

THE Lighting Department of Copen- hagen are prepared to receive TENDERS for the supply and delivery of 150,000 Tons of best GAS COAL from the beginning of March until the end of December, 1904.
The Lighting Department reserve the right to divide the Contracts between two or more Contractors.
Further Information and Conditions for the delivery may be obtained on application to Direktören for Köbenhavns Belysningsvæsen, Vestre-Boulevard 22, Copenhagen B.
The Tenders, sealed and marked "Tilbud paa Kul," to be sent to Direktören for Belys, Ningsvæsnet, Vestre-Boulevard No. 22, Kobenhavn B, before the 19th of January, 1904, Twelve o'clock, at which time the Tenders will be opened in the presence of the parties tendering who are in attendance.

THE LIGHTING DEPARTMENT OF COPENHAGEN.
Dec. 22, 1903,

NEW RIVER COMPANY.

ISSUE OF £100,000 THREE PER CENT. DEBENTURE STOCK "C,"
Authorized by the New River Company's Act of 1896,
AND OF
£200,000 THREE PER CENT. DEBENTURE STOCK "D,"
Authorized by the New River Company's Act of 1897.

NOTICE is Hereby Given, that the Directors are prepared to receive TENDERS for the above ISSUES, bearing Interest at Three per Cent. per Annum and redeemable at par at any time after the expiration of 25 Years from the date of issue upon Six Months' previous Notice being given by the Company.
Particulars, Conditions of Sale, and Forms of Tender may be obtained at the Company's Office, Rosebery Avenue, Clerkenwell, E.C.
Sealed Tenders are to be delivered at the New River Office not later than Ten o'clock a.m., on Thursday, the 14th of January, 1904.
The Reserved Price, below which no Tenders will be accepted, will be fixed early in January.
N.B.—On the transfer, pursuant to the Metropolis Water Act, 1902, of the Water Undertaking of the Company to the Metropolitan Water Board, these Debenture Stocks will, under the provisions of that Act, be secured on the whole Water Fund of the Water Board, and have, in addition, the security on the rates provided by the Act.
The Stocks are a lawful investment for Trustees.

By order of the New River Company,
JAMES SEARLE,
Clerk.
New River Office, Rosebery Avenue,
Clerkenwell, E.C., December, 1903.

SOUTH METROPOLITAN GAS COMPANY.

NOTICE is Hereby Given, that the Directors of this Company will OFFER the sum of £100,000 ORDINARY STOCK "to all the Gas Consumers and Persons in the employ of the Company," pursuant to the provisions of the South Metropolitan Gas Act, 1901.
Full Particulars thereof, together with the Price of such Stock, will be sent to the Consumers with the gas accounts for the Christmas quarter.

By order,
FRANK BUSH,
Secretary.
Offices: 709, Old Kent Road, S.E.,
Dec. 16, 1903.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to Capital Stocks, WILL BE CLOSED at Four o'clock p.m. on Tuesday, the 5th day of January next, and will be RE-OPENED immediately after the Half-Yearly Ordinary General Meeting of the Company to be held on the 5th day of February next.

By order.
HENRY RAYNER,
Secretary.
Chief Office: Horseferry Road,
Westminster, S.W., Dec. 23, 1903.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
CROYDON COMMERCIAL GAS AND COKE COMPANY.

NEW ISSUE OF £9620 FIVE PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 19, 1904, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

LOWESTOFT WATER AND GAS COMPANY.

SALE BY AUCTION OF 400 ADDITIONAL ORDINARY £10 SHARES,
Ranking for 7 per cent.; the Dividend on similar Shares in the Company having been 5¼ per cent. for several Years past. Also
£1000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, London, E.C., on Tuesday, Jan. 19, 1904, at Two o'clock, in Lots, by order of the Directors.
The Company, incorporated in 1853, supplies Water and Gas in Lowestoft and the surrounding District. The water-rental in 1891 was £7146, in 1902 it exceeded £14,000; and the Gas consumption has advanced from 43 Million cubic feet in 1891 to upwards of 73 Millions in 1902. New works to keep pace with the increasing demand for Water and Gas are necessary; and it is for these works that the New Capital is being raised.
Particulars of Sale, and Form of Instructions for the Auctioneer or Secretary to purchase for Investors unable to attend the Auction, obtainable post free of the SECRETARY of the Company, 137, London Road, LOWESTOFT, and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

COKE-BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT)
With Elevators and Conveyors worked by Steam or Gas Engine.

GEORGE WALLER & SON,
165, QUEEN VICTORIA STREET, E.C.;
And at STROUD, GLOUCESTERSHIRE.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

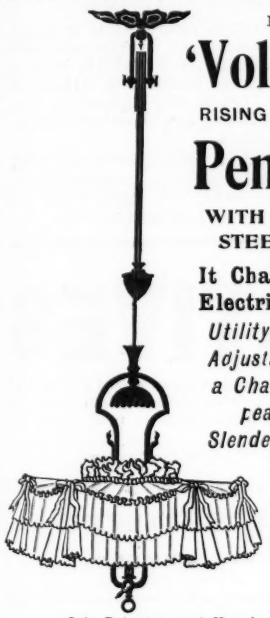
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY
RAVENSTHORPE, NEAR DEWSBURY.

TROTTER, HAINES, & CORBETT, LIMITED,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 84, OLD BROAD STREET, E.C.

A Revolution in Gas-Fittings



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'Volonta'
RISING & FALLING
Pendant
WITH FLEXIBLE STEEL TUBES.
It Challenges the Electric Light for *Utility, Novelty, & Adjustability, and a Charming Appearance of Slender Elegance.*

Patented in many Countries.

Sole Patentees and Manufacturers:
EDWARD J. SHAW & CO., WALSALL.

THE PERFECT MANTLE CO.
Y.
1c, Aldgate Avenue, London, E.C.

MANUFACTURERS OF THE WELL-KNOWN
SUPERIOR "PERMCO"
MANTLE, IN COTTON AND RAMIE.

Under Welsbach Licence. Can be used legally with any Burner.
Trade Price 26s. 6d. per Gross.
Reduction for Quantities

WELDON MUD
FOR
GAS PURIFICATION,
For use in the
RECOVERY OF SULPHUR,
Also Removal of last Traces of
SULPHURETTED HYDROGEN
in catch position.

Full Particulars on application to the Patentees:
GAS DESULPHURIZATION CO.,
— LIMITED, —
1, FENCHURCH AVENUE, LONDON, E.C.

FIRE

That will satisfy your most fastidious Customer.

BRILLIANT. WARM. NOISELESS.

Send small Sample Order.
Your further Orders will follow.

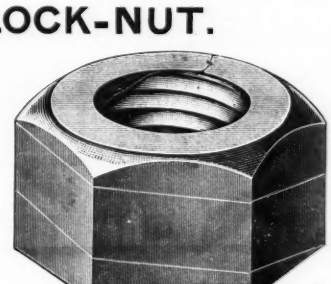
THE IMPERIAL STOVE CO.,
LEAMINGTON SPA.
Telegrams: "Imperial, Leamington."
Telephone: One X.

GOLD MEDAL FOR FIRES AWARDED 1903.
GOLD MEDAL FOR COOKERS AWARDED 1903.

HEATHCOTE GAS COAL.
Rich in Illuminating Power and Yield of Gas
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,
CHESTERFIELD.

BAYLISS'S
HAVE ACQUIRED
THE
PATENT
"HELICOID"
LOCK-NUT.



A Coil of Steel Gripping Automatically with Immense Power.
SECURITY. ECONOMY. DURABILITY.
THE MORE THE VIBRATION, THE TIGHTER THE NUT GRIPS.
Made from ⅛ in. to 2 in. Price from 10s. 9d. per gross.
COMPLETE LIST FREE.

BAYLISS, JONES & BAYLISS, LIMITED
ALSO MANUFACTURERS OF
IRON AND WIRE
FENCING,
GATES, &c.
VICTORIA WORKS, **WOLVERHAMPTON.**
London Offices & Show Rooms, 139 & 141, Cannon Street, E.C.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to **Mr. EDWARD PRICE,** "Langley," Wyke Avenue, **WORTHING.**

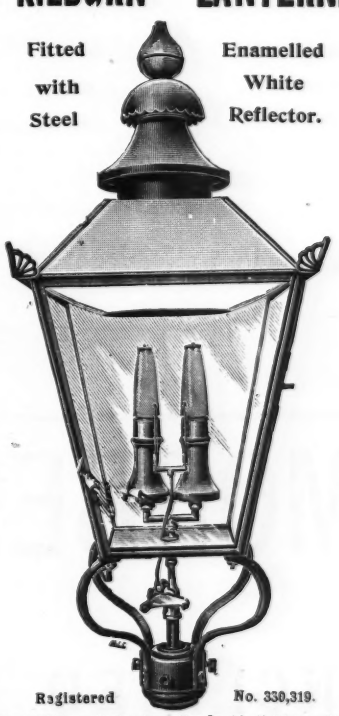
NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

THE
"KILBURN" LANTERN.

Fitted with Steel
Enamelled White Reflector.



Registered No. 330,319.

The "Kilburn" Lantern (for double lights) and the "St. Albans" Lantern have been adopted for lighting the Town of St. Helens.

H. GREENE & SONS, Limited,
Surrey Engineering Works,
Blackfriars Road, LONDON.
Telephone 1693 HOP.
Telegrams: "LUMINOSITY LONDON."

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

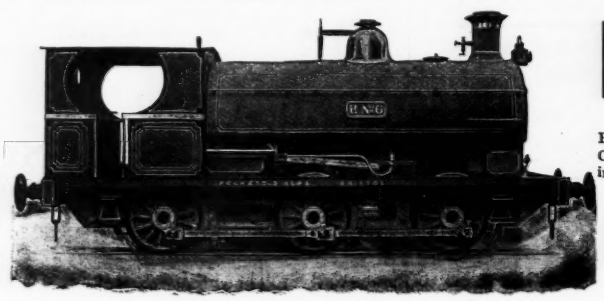
CASES FOR BINDING
QUARTERLY
VOLUMES OF THE "JOURNAL."
(GREEN CLOTH, GILT LETTERED).

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.
Prices and Analysis of all the Scotch Cannels on Application.

THE
PETROLEUM GAS SYNDICATE
Supply and erect Complete Installations of their
PETROGENE PATENT GAS PLANT
On SALE, HIRE, or ROYALTY.
PETROGENE GAS is the most suitable Illuminant for all Towns, Villages, Factories, Institutions, &c., where a Cheap and Efficient Lighting System is required. It is equally suitable for Heating and Power purposes, and may be used with ordinary Gas Fittings, Stoves, Engines, &c. It may also be used in conjunction with Coal Gas, and affords Gas Companies a ready means of increasing their output without the expense of additional storage.
The Syndicate is prepared to entertain offers of e of small Gas-Works, whether profit earning or not.
Offices: **28, Victoria St., Westminster.**
Works: **10, Rochester Row, S.W.**

THE
"ROTARY"
STATION METER.
Efficiency
Demonstrated.
APPLY—
T. G. MARSH,
MAWSON CHAMBERS, DEANSGATE,
MANCHESTER.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road
CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.



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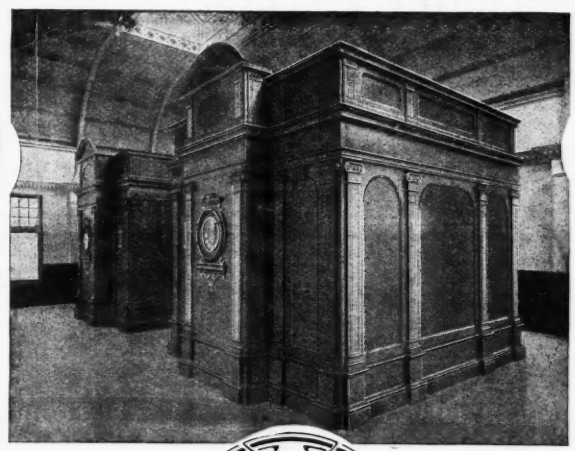
LOCOMOTIVES of all Sizes and Gauges specially constructed for Main and Branch Lines, Contractors, Docks, Gas-Works, Collieries, Iron-Works, Brick and Cement Works, &c. Locomotives of various Sizes always in Stock, ready for immediate Delivery.
Photographs, Specifications, and Prices on Application.
PECKETT & SONS, Atlas Locomotive Works, **BRISTOL.**
Telegraphic Address: "PECKETT, BRISTOL."

TELEGRAMS, "UNBEATEN," BIRMINGHAM.
TELEPHONE Nº 815.
GAS, WATER & STEAM TUBES
THE STAFFORDSHIRE TUBE CO. LTD.
AND FITTINGS
HEAD OFFICE
Edmund Street, BIRMINGHAM

MOBBERLEY & PERRY,
STOURBRIDGE.
INCLINED RETORTS A SPECIALITY.
HORIZONTAL AND SEGMENTAL RETORTS.
BEST QUALITY OF FIRE-CLAY GOODS.
Specials for Water-Gas Plants. Chequer Bricks always in Stock.

R. LAIDLAW & SON,
LIMITED
GAS & WATER ENGINEERS,



SIMON SQUARE WORKS. EDINBURGH.

6 LITTLE BUSH LANE, LONDON, E.C.

TWO STATION METERS EACH TO PASS 200000 CUB. FT PER HOUR. ERECTED AT THE

GRANTON GAS WORKS FOR THE EDINBURGH & LEITH GAS COMMISSIONERS.

ALLIANCE FOUNDRY & ENGINEERING WORKS, GLASGOW.

CARRON CO.

WORKS: Carron, Stirlingshire, N.B.

CARRON PATENT

HYGIENIC INDUCTION CONDENSING GAS-STOVE

The "LANCET" of the 24th of January, 1903, published the Report on this new system of producing radiant heat from Gas, by the introduction of vapour into hot Gases, for the purpose of increasing expansion, by which the same kind of Heat is produced as by the Electric current, at one-tenth of the cost. These Stoves are constructed of Cast Iron without any Sheet Metal Tubes, and supplied black or enamelled in colours.

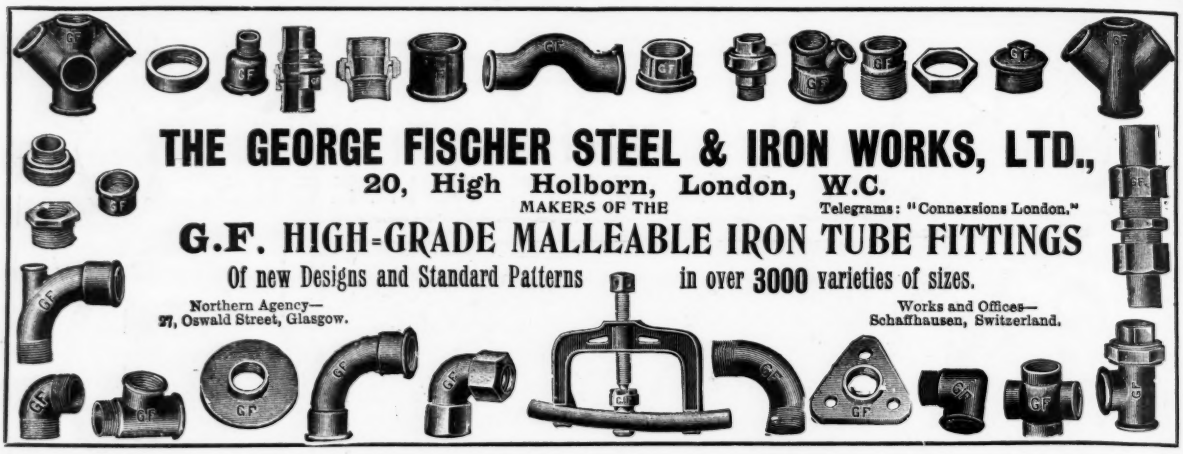
Larger sizes are made with Two Burners or Asbestos Gas Fires.

SIZE—1 ft. 9 in. wide, 3 ft. high, 7 in. deep.

PRICE.

Fine Cast and Blacked.	£3 3 0
Do. with Polished Brass Ornament and Electro-Bronzed Panel .	4 0 0
Ground and Berlin Blacked, Best Finish	4 5 0
Do. with Polished Brass Ornament and Electro-Bronzed Panel. .	5 2 6
Majolica Enamelled	4 7 6

AGENCIES—LONDON: 15, Upper Thames Street, E.C.; GLASGOW: 125, Buchanan Street; BRISTOL: 10, Victoria Street; LIVERPOOL: 30, Redcross Street; MANCHESTER: 24, Brazennose Street; NEWCASTLE-ON-TYNE: 13, Prudhoe Street; BIRMINGHAM: Guildhall Buildings, Stephenson Street.



THE GEORGE FISCHER STEEL & IRON WORKS, LTD.,
20, High Holborn, London, W.C.
MAKERS OF THE Telegrams: "Connexsions London."
G.F. HIGH-GRADE MALLEABLE IRON TUBE FITTINGS
Of new Designs and Standard Patterns in over **3000** varieties of sizes.
Northern Agency— 27, Oswald Street, Glasgow.
Works and Offices— Schaffhausen, Switzerland.

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GAS BRACKETS FOR INVERTED BURNERS

DESIGNED and MANUFACTURED by
JAMES MILNE & SON, LTD., EDINBURGH. LEEDS. LONDON. GLASGOW.

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SAML. CUTLER & SONS, MILLWALL, LONDON.

GASHOLDERS OF EVERY DESCRIPTION.

CUTLER'S PATENT GUIDE FRAME FOR GASHOLDERS

Adopted for many large and important Gasholders.

CUTLER'S PATENT FREEZING PREVENTER

FOR GASHOLDER CUPS AND TANKS.

In extensive use in English, Continental, and American Works.

LARGE STEEL TANKS A SPECIALITY

Gasworks Plant of every kind.

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And other Castings

CONDENSERS,
SCRUBBERS,
WASHERS,
VALVES,

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GASHOLDERS

AND

GAS PLANT

OF

EVERY KIND

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Works Remodelled
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ONE THOUSAND *Workmen.*

ASHMORE, BENSON, PEASE, & CO., Ltd.,
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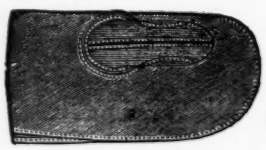

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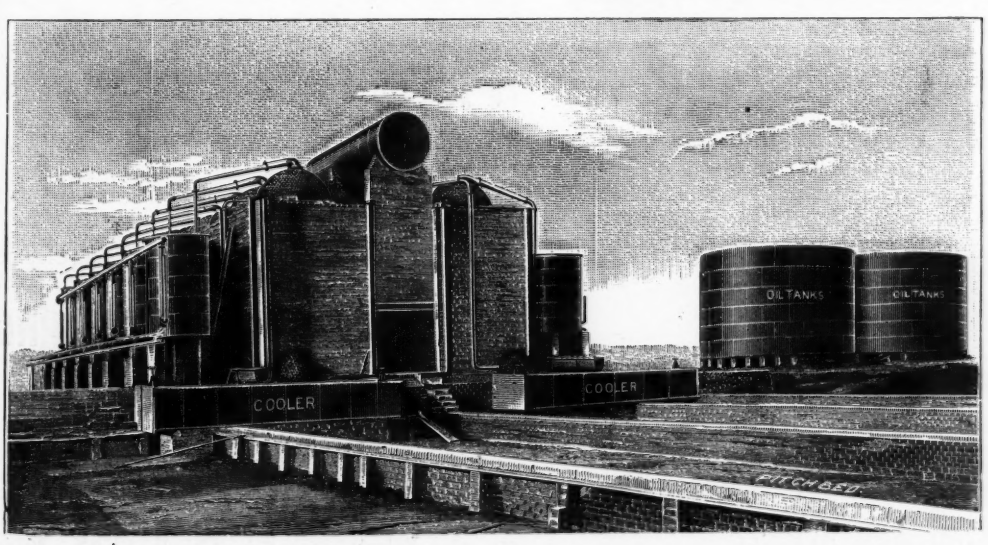

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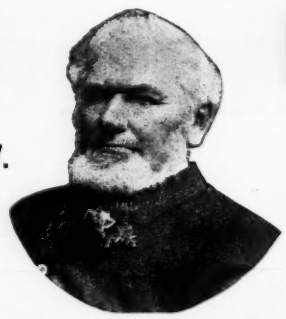
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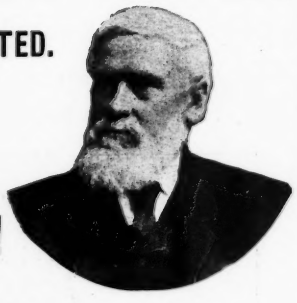
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WATER SUPPLY & SANITARY IMPROVEMENT

[REGISTERED AS A NEWSPAPER.

VOL. LXXXIV. No. 2120.] LONDON, DECEMBER 29, 1903. [55TH YEAR. PRICE 6d.

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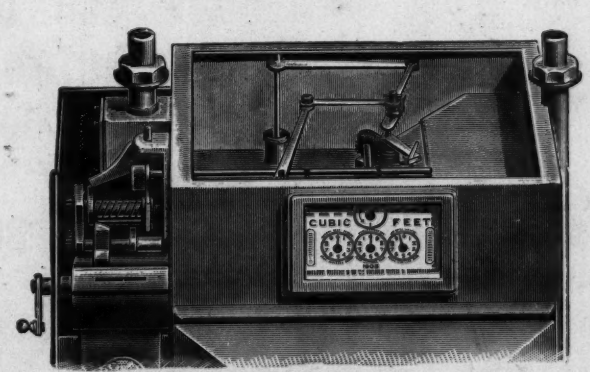

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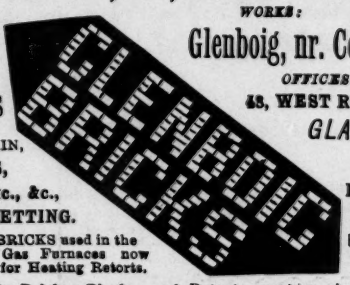

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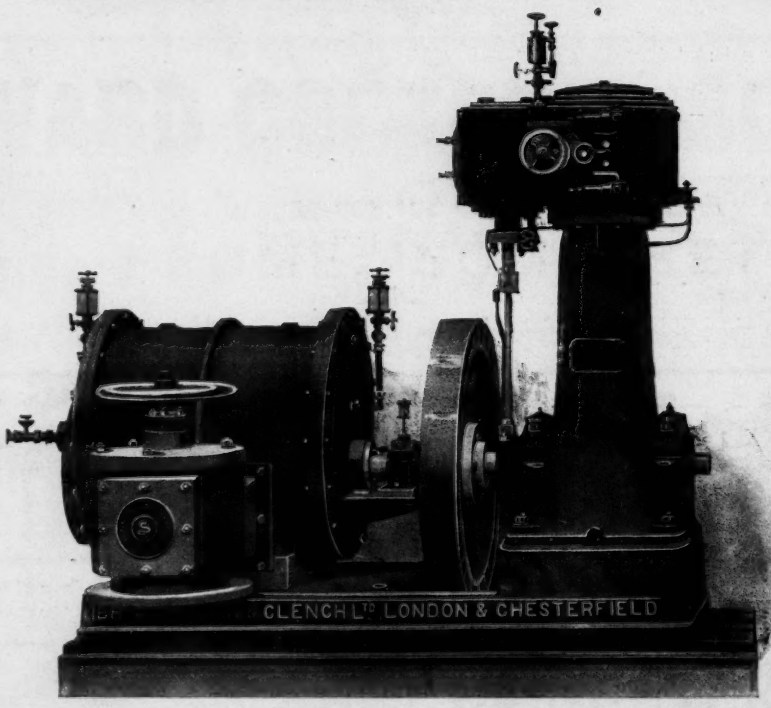

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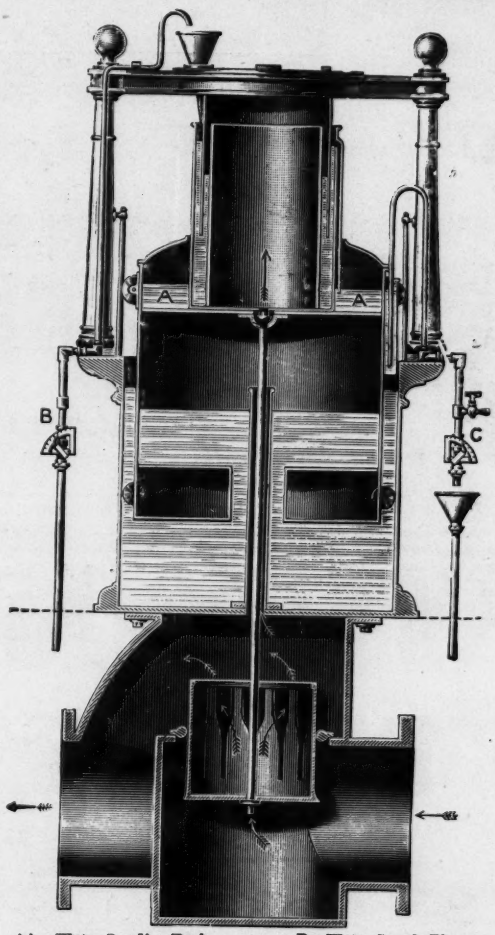

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